INTELLIGENT
REACTIVE POWER MANAGEMENT

RM-12P 3-Phase



User's Manual

SUMMARY

ATTENTION!

Consult the operating instructions before using the equipment. If these precautions are not properly observed and carried out, it can cause physical accident or damage to the equipment.
We thank you for your smart choice. To obtain the best results from your equipment:
- carefully read the operating instructions,
- observe the precautions mentioned in this user manual.

Precautions for Safe Use and Installation

1) Maintenance, installation and operation of RM-12P must be performed only by the qualified electricians.
2) Do not operate undervoltage.
3) Do not open the RM-12P's housing. There are no user servicable parts inside it.
4) RM-12P is connected to the network by means of a current transformer. Do not disconnect the current transformer terminals. If you disconnect them, be sure to short-circuit or connect them to another parallel load which have low impedance. In case of failure, dangerously high voltage at the secondary side of current transformer may cause an electric shock.
5) Do not use this product for any other purpose than its original task.
6) When device is connected to the network, do not remove the front panel.
7) Do not clean the device with solvent or similar items. Only clean with a dried cloth.
8) Verify terminal connections when wiring.
9) Electrical equipment should be serviced only by your competent seller.
10) Device is only suitable for panel mounting.

No responsibility is assured by the manufacturer or any of its subsidiaries for any consequences rising out of the use of this material.

Important Note for System Connection.

1) First, connection type of auxiliary supply, voltage measurement input and current measurement input must be 3 phase-neutral. Device must be operated after completing the 3-phase connections.
2) Always a 3-phase capacitor must be connected to the first step. Remaining single phase and 3-phase capacitors can be connected to any other step.

Do not power-up the device before verifying terminal connections.

Generator Input

Target **"Cosφ2"** is activated and target Cosφ is disabled, which are programmed in the menu, when the voltage (110~250 V AC) is applied to the generator input.

Monitoring the measured temperature

In order make a correct measurement, J type (Fe/Cu-Ni) thermocouple must be connected to "TEMP" terminal and keep worked at least 30 min. In order to observing the measured environmental temperature, press UP/DOWN buttons untill the displaying the "xxx.x ºC " value.

NOTE: RM-12P temperature measurement feature is optional.

1. INTRODUCTION

1.1 General Information

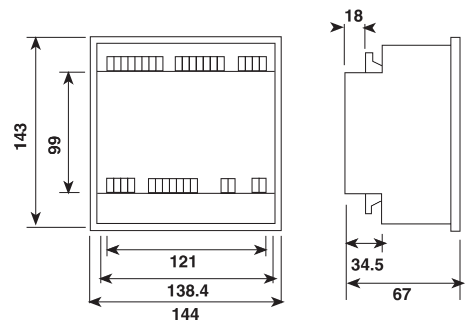
Power factor controllers are used for measurement and control of power factor control units for central reactive power compensation. The power factor, which is defined as ratio of active power (W) to apparent power (VA), measured by power factor controller is compared with the set values to provide necessary compensation.
RM-12P power factor controller is designed for reactive power compensation in single phase and 3-phase systems.
RM-12P compensates each phase separately and so, this makes RM-12P series a unique solution for unbalanced load compensation. In order to perform this process, single phase and 3-phase capacitor steps must be connected to the device at the same time.

Measured Parameters :

1) Phase Voltage ($L_{1,2,3}$-N) Measurement
2) Phase Current ($L_{1,2,3}$-N) Measurement
3) Cosφ Value ($L_{1,2,3}$-N) Measurement
4) Average (Ind./Cap.) Cosφ Value Measurement
5) Active Power (W), Reactive Power (VAr), Apparent Power (VA) Measurement
6) Total Active Power (Ind./Cap.), Total Reactive Power (Ind./Cap.), Total Apparent Power (Ind./Cap.) Measurement
7) Active Energy (Wh-Import/Export), Reactive Energy (VArh-Import/Export) Measurement
8) Measuring up to 19th Harmonic (V, I, W, VAr, VA) $_{1,3,5,......,19}$
9) *Temperature Measurement

*Optional

DIMENSIONS



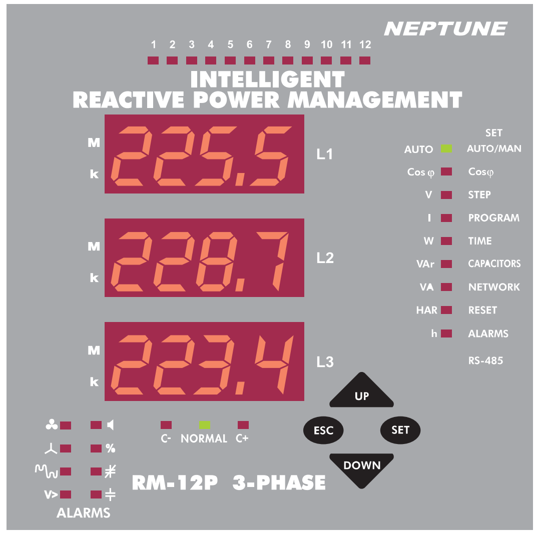
Type PR16 (144x144)

1) Panel cut-out dimension must be 139 mm x 139 mm (Type PR16).
2) Before installation, remove the mounting brackets.
3) Mount the device to the front panel.
4) Insert the mounting brackets.
5) Wire thickness for voltage and current terminals must be 2,5 mm^2.
6) CAT5 cable is recommended for RS-485 input terminal.

Excessive force can damage the device.
Turn the screw into the terminals and tighten until the RM-12P is secured in place.

1.2 Front Panel

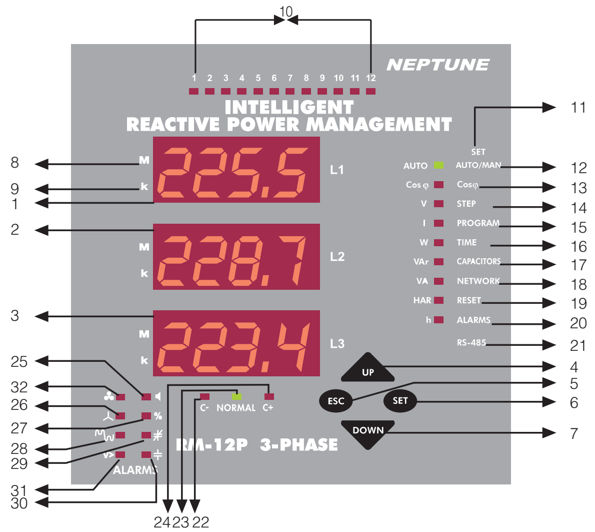
On the front panel, 3 display lines, 4 buttons and also alarm, capacitor step and display leds exist. Measured parameters are observed in the related displays. Displayed values for related parameters are selected via indicator leds. When an alarm exists, related alarm led blinks. 12 capacitor step leds indicates, which capacitor step is switched on. Detail information about buttons, display, alarm and capacitor step leds will be explained in the coming sections.



1.2.a Button Functions

UP : Go to next menu or increase related value.
DOWN : Go to previous menu or decrease related value.
ESC : Exit from a menu or cancel the data entry.
SET : Enter to a menu or confirm the data entry.

1.2.b Front Panel Functions



⚠ In order to enter to the menu, "SET" button must be pressed for 3 seconds.

1. L1 : Display of phase 1.

2. L2 : Display of phase 2.

3. L3 : Display of phase 3.

4. Up Button : Go to next menu or increase related value.

5. Esc Button : Exit from a menu or cancel the data entry. (In the measurement mode, it is used to exit from harmonic menu)

6. Set Button : Enter to a menu or confirm the data entry. (In the measurement mode, it is used to observe the harmonic values of current, voltage and power values)

7. Down Button : Go to the previous menu or decrease related value.

8. M Led : Represents measurement values with mega unit ($x10^6$).

9. k Led : Represents measurement values with kilo unit ($x10^3$).

10. 1,2,3,.......,12 Leds : Shows the status of each capacitor steps.

11. SET Menu : Programmable menus which are set by pressing SET button for 3 seconds.

12. OTO/MAN Led : Indicates if the operating mode is automatic or manual. (If it is continuously ON, RM-12P operates in Automatic Mode. If it blinks, RM-12P operates in Manual Mode)

13. Cosφ Led : If Cosφ light is ON, target Cosφ value can be set between Inductive 0,8 - Capacitive 0,8 (In the measurement mode, Cosφ values of related phases are displayed).

14. Step / V Led : Press SET button for 3 seconds, select "STEP/V" light to select step number (In the measurement mode, voltage values of related phases are displayed).

1 5. Program / I Led : Press SET button for 3 seconds, select "PROGRAM/I" light to select power sequence program. (In the measurement mode, current values of related phases are displayed)

16. Time / W Led : Press SET button for 3 seconds, select "TIME/W" led to set switching on delay time, switching off delay time and discharge time. (In the measurement mode, active power and total active power (Ind./Cap.) values of related phases are displayed)

17. Capacitors / VAr Led : Press SET button for 3 seconds, select "CAPACITORS/VAr" led to set capacitor values and capacitor connections (R, S, T, RST). (In the measurement mode, reactive power and total reactive power values of related phases are displayed).

18. Network / VA Led : Press SET button for 3 seconds, select "NETWORK/VA" led to set current transformer ratio (Ctr), Voltage transformer ratio (Vtr) and calculation method (Calc). (In the measurement mode, apparent power and total apparent power values of related phases are displayed)

19. Reset / HAR Led : Press SET button for 3 seconds, select "RESET/HAR" led to reset energy values, reactive energy ratios and alarms.

20. Alarm / h Led : Press SET button for 3 seconds, select "ALARM/h" led to set alarms for overvoltage, reactive/active ratio, temperature and harmonics.

21. RS-485 : In this menu, address, baudrate and parity values for RS-485 communication protocol are set.

22. C- Led : This led represents that RM-12P is waiting for switching capacitor steps off.

23. Normal Led : This led represents that RM-12P will not switch any capacitor steps on&off.

24. C+ Led : This led represents that RM-12P is waiting for switching capacitor steps on.

25. 🔈 : In case of any failure, alarm relay switches on and alarm led lights.

26. ⅄ : In case of connection failure, "⅄" led lights.

27. % : If reactive energy ratios exceed preset values, "%" led lights.

28. ∿ : If voltage harmonic ratios exceed preset values, "∿" led lights.

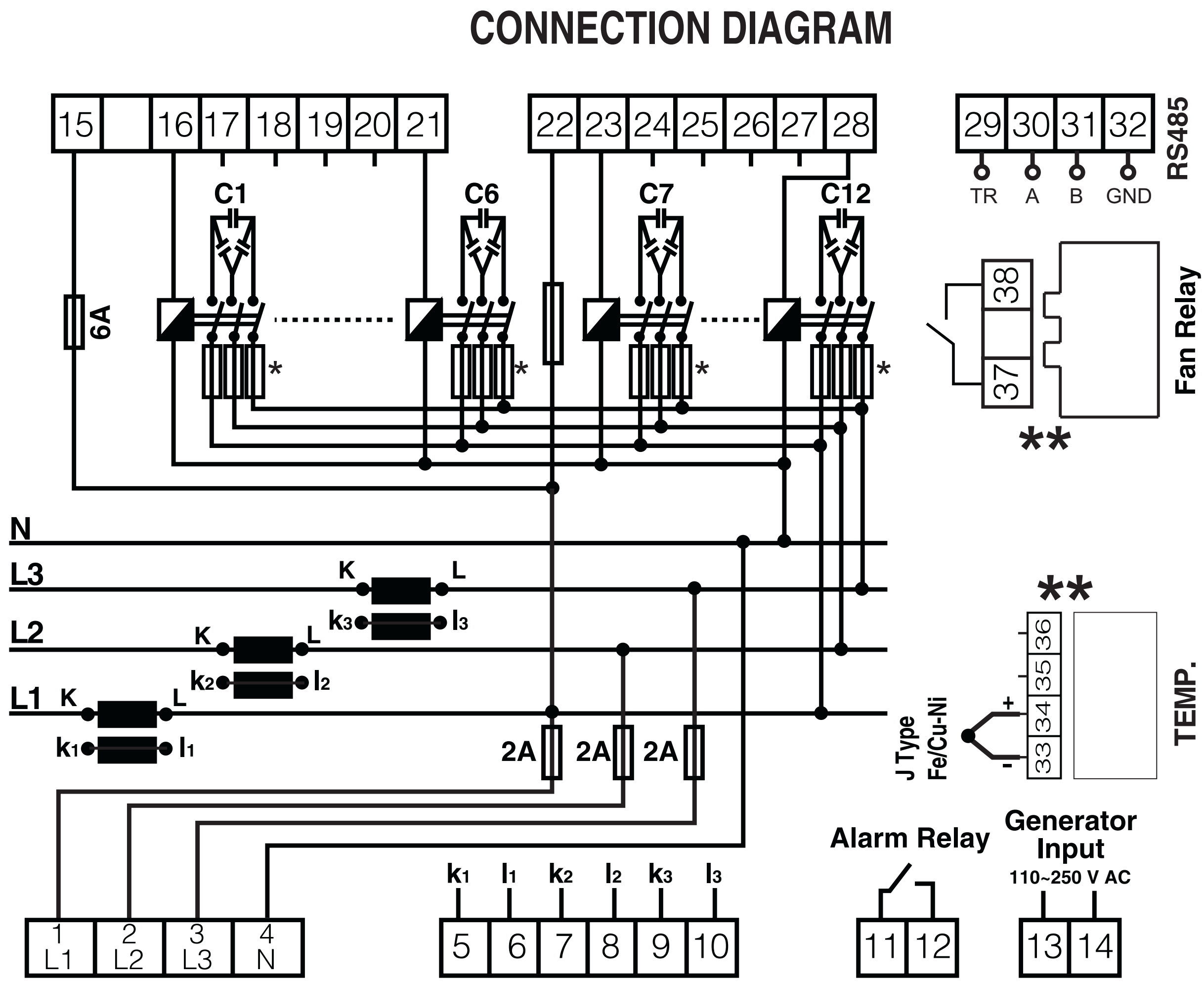
29. ≢ : When target power factor value is not reached although all the capacitor steps are switched on, "≢" led lights.

30. ≑ : If capacitor is not connected to the related step, "≑" lights is ON.

31. V> : When voltage value exceeds preset value, "V>" light is ON.

32. ♣ : When measured temperature value increase fan measured value after 10 second fan led light will be on (This is optional).

1.3 Rear Panel



***** Current value of 3-Fuses, which are connected to protect the capacitors, is chosen according to the nominal current value of capacitors.
****** Optional.

Warnings :

a) Connection type of auxiliary supply, voltage measurement input and current measurement input must be 3 phase-neutral. Device must be operated after finishing of the 3-phase connections.

b) After the device has energized, it finds connection errors and corrects automatically.
Phase current should not be aqual to zero in order to let the device to sense the connection error. Device sense the connection error according to Active Power direction.
Device switching “ON” and “OFF” the 1st step’s 3-phase capacitor during the correction of connection errors (Phase sequence error and polarity error of Current Transformer). Device may not correct the connection errors if there are too many instant variations for loads and nonlinear loads (Such as Thyristor or triac controlled frequency inverter, UPS etc.). In this case, user should disconnect the device and restart it to making the same operation.
This operation also can be operated as “turning ON” the “Auto SET” function in “Auto” menu. In this case device corrects the errors and then calculates the capacitor values.

c) After connection errors are corrected; capacitor steps are calculated with turning “ON” the “Auto Setup” function in “Auto” menu (Refer to “Automatic Capacitor Recognition” menu).
It is an obligation to connect a 3-phase capacitor for 1st step. All steps are measured seperately if the program-10 (PS-10) is selected in “Program” menu. In this program (PS-10); single or 3-Phase capacitors can be connected according to requirements of the system in any sequence.In case of choosing one of the other programs, device measures the 1st step’s power value and then calculates the other steps respectly to this value. Device calculates the capacitor values which will be switched “ON” according to selected program; device switches “ON” / “OFF” the required steps.

d) Connection of circuit breaker or automatic fuse is highly recommended between the network and RM-12P. Circuit breaker must be in close proximity to the device.

e) All used fuses must be FF type and the current values of the fuses must be 2A or 3A and 6A (Refer to Connection Diagram).

f) Generator input must be activated only when the network is supplied by the generator. Otherwise device will be switched to the generator position for every kind of generator starts including the maintaining purposes.

g) In order make a correct measurement, J type (Fe/Cu-Ni) thermocouple must be connected to “TEMP” terminal.

2. INSTALLATION

- For proper operation, 3-Phase, neutral, voltage and current terminals must be connected as in the connection diagram. Device does not work properly without 3-phase connection.
- The most important point is connecting 3-phase capacitor to the first step. Remaining single phase and 3-phase capacitors can be connected to the other steps.
- After capacitor steps' connection, if temperature measurement function will be used, J-Type 0-400 V thermocouple must be connected. (Temperature measurement feature is optional)
- Lastly, computer communication connection must be done.
- Do not power-up the device before verifying terminal connections.
- **To first step, always a 3-phase capacitor must be connected.**

2.1 Commissioning

Warning: If fast load variation exists together with compensation capacitors, device can not detect correct connection at first time and may find after several attempts. If device can not finish this detection, C/k calculation can not be accomplished.

- When RM-12P is powered-up for the first time, if the power value of any phase is negative, RM-12P switches on&off the first capacitor step automatically and it recognizes and records the connections.
- Later, automatic setup (Refer to page 6 - Automatic setup) is selected on the menu in order to automatic recognition of the connections and connected capacitor steps.
- After automatic recognition, RM-12P checks all capacitor step values. If variable loads exist in the system, first of all these variable loads must be disconnected and then automatic setup process must be done. Otherwise, power factor controller may not measure capacitor step powers correctly. Capacitor step powers and connection types also can be recognized to the power factor controller manually.

(Refer to page 10 - Setting of the capacitor's connection and power values)

- After the recognition of capacitor step powers, target Cosφ value is set in order to start the compensation. Factory set value for target Cosφ is ind. 1.000 and Cosφ2 is ind. 0.900

Note: PFC decreases the switching on&off time to 3 seconds in Automatic Setup mode but discharge time is not changed. After the automatic setup process, set values become valid.

2.2 Capacitors Sequence

Device finds connection errors and corrects automatically. Power values of the capacitor steps are measured automatically according to program selection. If PS-10 program is selected, power values of all capacitor steps are measured (Refer to Program Section). If any other program is selected, device measures first capacitor step value and then calculates other capacitor steps according to the selected program. For this reason,
a 3-phase capacitor must be connected to the first step. Then, single phase and / or 3-phase capacitors can be connected with random sequence to the other steps.

3. SETTINGS

3.1 Operating Mode and Capacitor Power Settings

3.1.a Operating Mode Setting

RM-12P has two operating modes which are automatic and manual. Manual mode is used for test purposes. In this mode, capacitor steps are switched on&off to test relay outputs. In manual mode, capacitor steps are switched on by **"SET"** button and **"ESC"** button. Factory set values for switching on (t-on) and switching off (t-of) time is 10 sec. These values can be changed by the "Delay" menu (Refer to delay time setting). In manual mode, step numbers, which will be switched on&off, can be programmed in "Step" menu (Refer to step number setting). Even if manual mode is selected, device switches to automatic mode after 5 minutes.

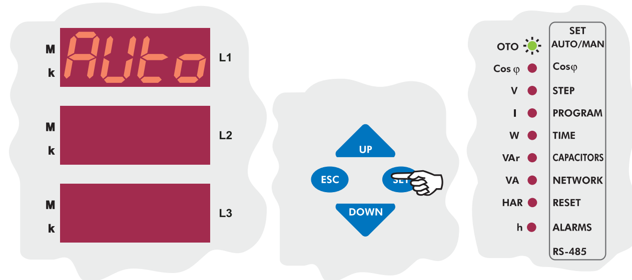
When automatic mode is selected, AUTO/MAN LED lights on continuously.
When manual mode is selected, AUTO/MAN LED blinks.

Warning: Device warns user by blinking (short ON, long OFF) led of the capacitor steps which will be switched on. Also device warns user by blinking (long ON, short OFF) led of the capacitor steps which will be switched off.

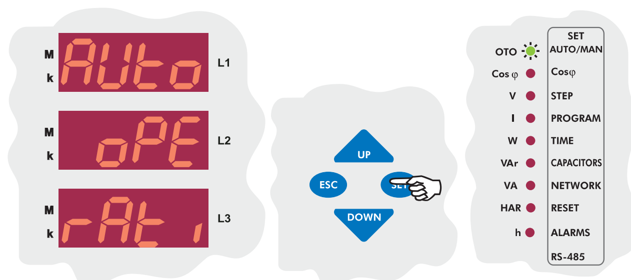
Numerical values of the parameters are set via buttons in the display. The blinking digit indicates which digit will be set. Numerical value of the related digit is increased or decreased via **"UP"** or **"DOWN"** button. To set the next digit, **"SET"** button is used and also **"ESC"** button is used to set the previous digit.

3 sec.

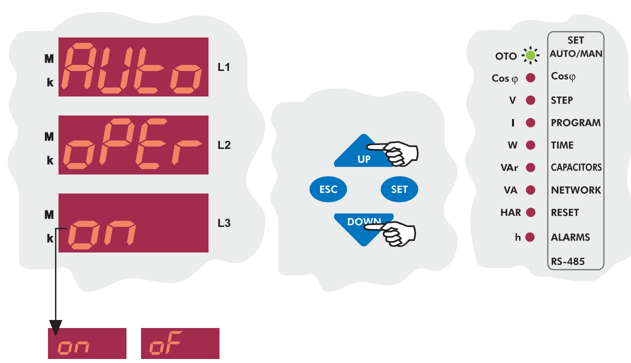
Press **"SET"** button for 3 sec. in order to enter to the menu.



Press **"SET"** button for parameter settings in **"Auto"** menu.



Press **"SET"** button to select the operating mode.
(on: Automatic Mode, of: Manual Mode).



*Press **"UP"** or **"DOWN"** button to select operating mode.*

3.1.b Automatic Mode Setting

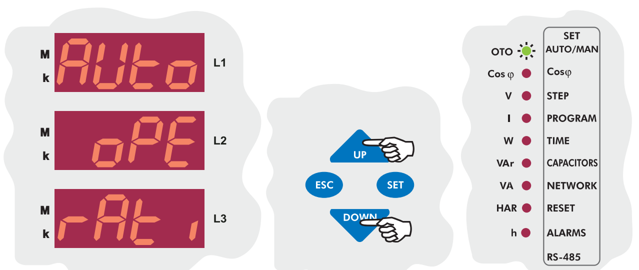
When device starts to operate, it checks connections and if there is a connection error, corrects it automatically. For this function, 3-phase voltage and current connections must completely be done.

Warning: If fast load variations exist together with compensation capacitors, device can not detect correct connection at first time but after several attempts. If device can not finish this detection, C/k calculation can not be accomplished.

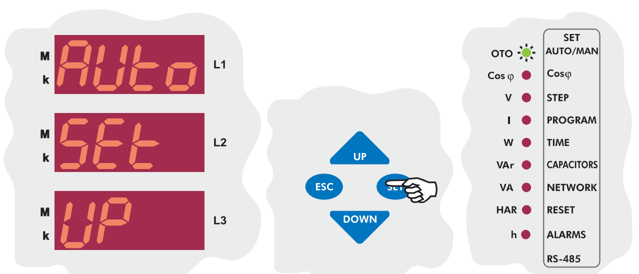
After correcting connection errors, if "Auto:On" option is selected device starts to measure capacitor steps automatically according to program selection. When PS-10 program is selected, all capacitor steps are measured. In other programs, only first capacitor step power is measured and other capacitor steps are calculated and recorded according to the selected program.

Note: After this process, calculated power values of all capacitor steps always must be controlled. In order to have correct power values for capacitor steps, current and voltage transformer ratios must be entered correctly. If current and voltage transformer ratios are not entered, these ratios are supposed to be "1" and capacitor powers are calculated according to these values.
(Refer to VT and CT ratio settings)

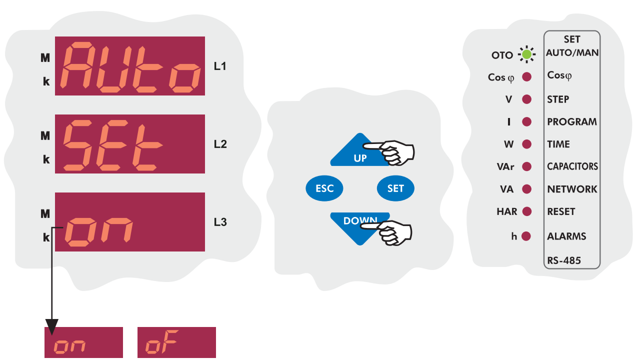
Note: If automatic setup is selected as "on", automatic mode starts immediately without waiting to escape from the menu.



In **"Auto operatı"** menu, press **"DOWN"** button to enter the **"Auto Setup"** menu.



Press **"SET"** button to change **Auto Setup** mode.
Press **"UP"** or **"DOWN"** button to enable **(on)** or disable **(of)** the Automatic Setup mode.



3.2 Target Cosφ Setting

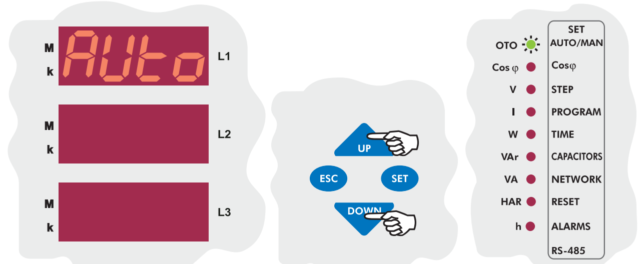
Target Cosφ value can be set between Ind. 0,800-Cap.0,800. RM-12P tries to reach system's Cosφ value to the set value. Cosφ set value must be in the range of the smallest capacitor step power (Q_{Ck}). Switching on and off demand occur outside of this range.

3.2.a Inductive Cosφ Setting

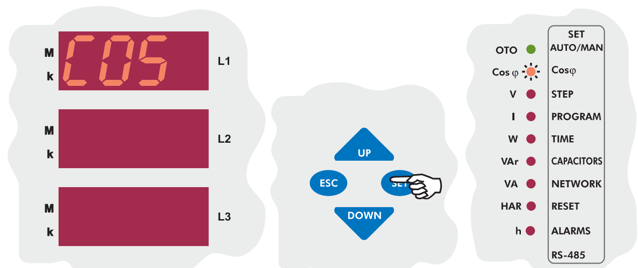
In this menu, required COSφ value in the inductive area is set.

3 sec.

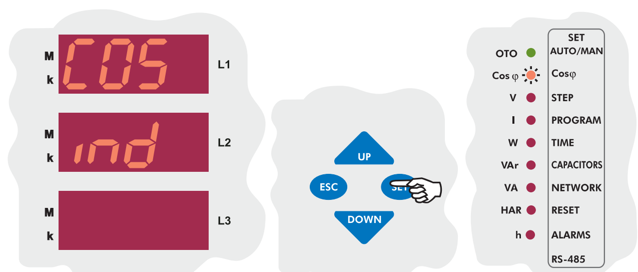

Press **"SET"** button for 3 sec. in order to enter to the menu.



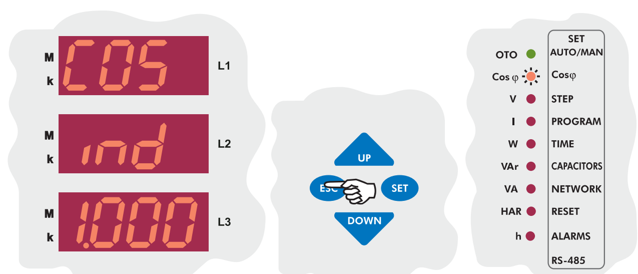
Find **"Target Cosφ"** menu by using **"UP/DOWN"** buttons. When **"Target Cosφ"** menu is displayed, Cosφ led lights on the display.



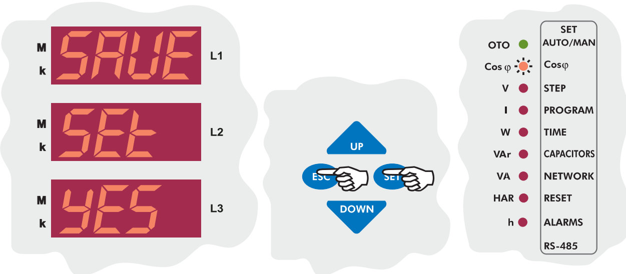
Press **"SET"** button for inductive Cosφ value setting in **"Target Cosφ"** menu.



Press **"SET"** button for inductive Cosφ value setting.



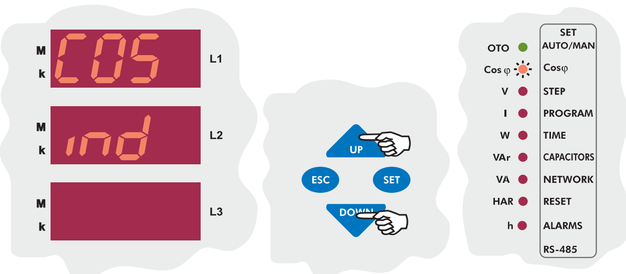
By **"UP/DOWN"** buttons, select inductive Cosφ value between 0,800 - 1,000 and then press **"SET"** button. To quit, press **"ESC"** button.



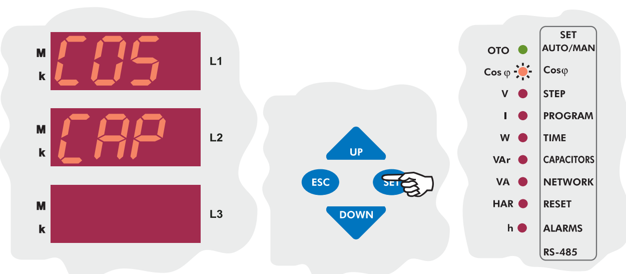
If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

3.2.b Capacitive Cosφ Setting

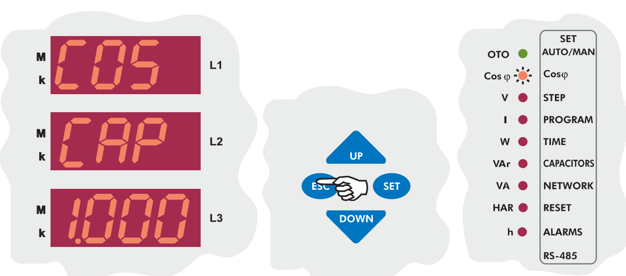
In this menu, required COSφ value in capacitive area is set.



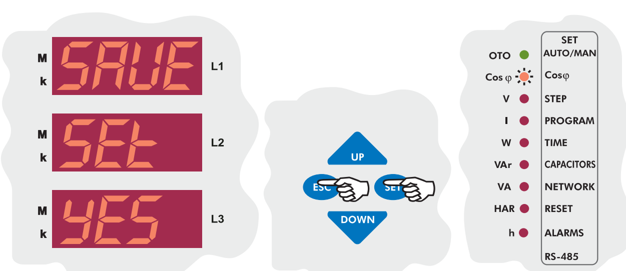
Press **“UP/DOWN”** buttons to set COSφ parameter.



Press **“SET”** button for Cosφ value settings in capacitive area.



Press **“UP/DOWN”** buttons to set capacitive Cosφ value between 0,800-1,000 and then press **“SET”** button. If you do not want to set another parameter, press **“ESC”** button.



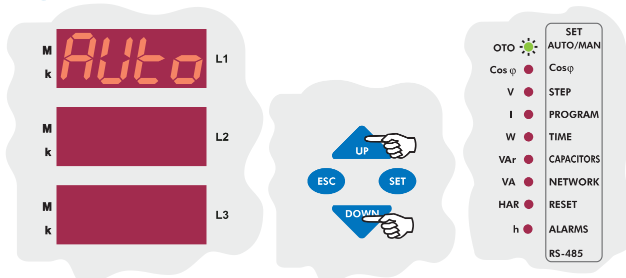
If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

3.3 Last Capacitor Step Number Setting

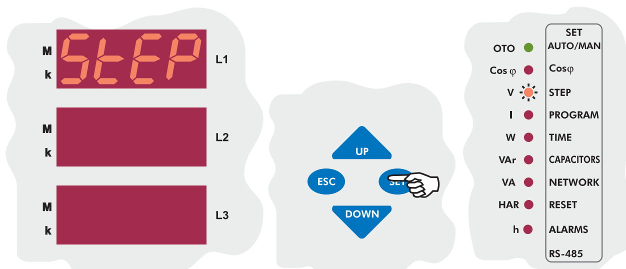
In this menu, last capacitor step number is set between 1-12 for RM-12P. For example, if this value is “8”, it means that first eight capacitor step (1......8) is selected. After this setting, device must be powered-up again.

Note : When program 10 (PS-10) is selected, device detects steps without capacitors automatically. These steps are always switched off by device. In this case, only capacitor connected steps are functional.

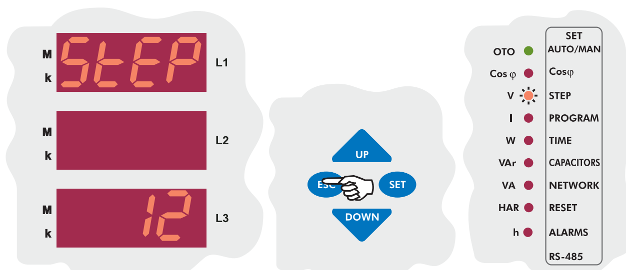
3 sec. Press **“SET”** button for 3 sec. in order to enter to the menu.



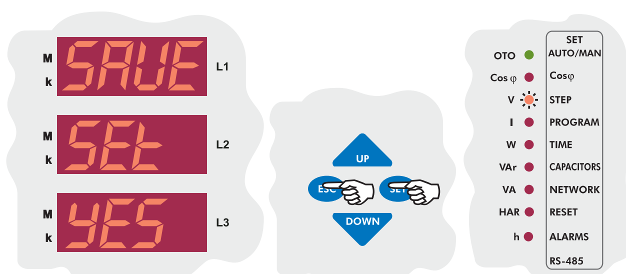
Press **“UP/DOWN”** buttons to find capacitor step number **(StEP)** menu. When step number menu is displayed, step led lights.



Press ***“SET”*** button to enter step number.



Press **“UP/DOWN”** buttons to enter step number between 1-12 and then press **“SET”** button. If you do not want to set another parameter, press **“ESC”** button.



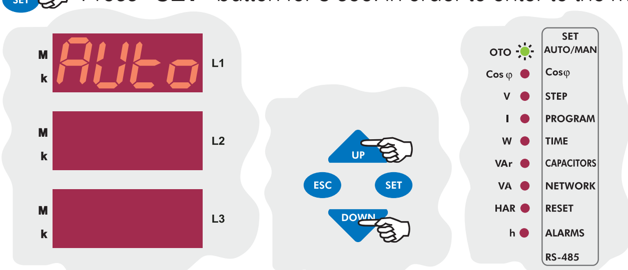
If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

3.4 Switching Program Setting

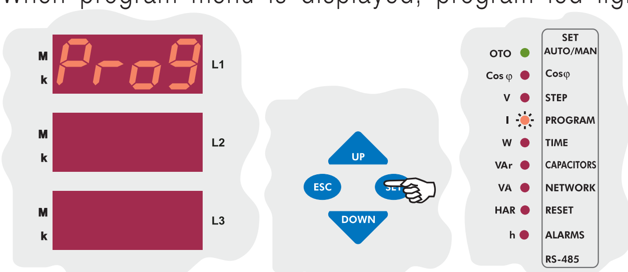
RM-12P has 10 different program modes which determines the power ratio sequence of the capacitor steps.
Three different switching programs are supported by RM-12P.
a) Linear Operation: The switching program begins always from the first step to the last one in both switching on and off mode. The advantage of this switching program is the possibility of a large selection of capacitor steps. This switching program is selected by "01" option.
b) Rotational Switching: This switching program is rotational between equal steps in the clockwise direction and this switching program is rotational to ensure that the capacitor switching cycles are uniformly distributed over all steps and to provide minimum switching steps for maximum service life time of the system. There are 8 different rotational switching programs (02, 03, 04, 05, 06, 07, 08, 09).
The ratio between capacitor steps is very important. When choosing the ratio between capacitor steps, the rating of each capacitor step value may exceed that of the first by a maximum amount equal to the of the preceding capacitor steps value.
c) PS-10 Program: If "PS10" program is selected, RM-12P calculates electrical parameters of the capacitor steps automatically. RM-12P counts swithing on&off times of all capacitor steps and so most necessary step is switched on. Thus, maximum service life time of the system is ensured.

NOT: In PS-10 program, connection types and power values of the single phase capacitor steps can be set by user. In Auto setup mode power values of all capacitor steps are measured.
In other switching programs, only first capacitor step's power value can be set (except PS-10 program). Other capacitor steps' power value are calculated automatically according to the first capacitor step's power value.

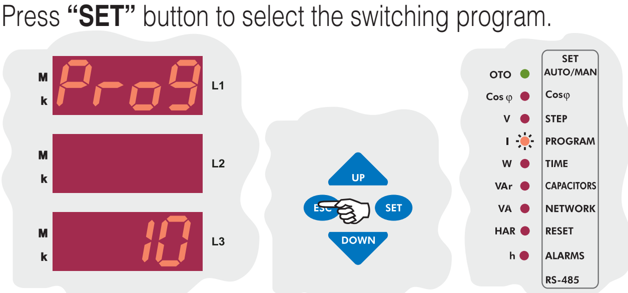
3 sec. Press **"SET"** button for 3 sec. in order to enter to the menu.



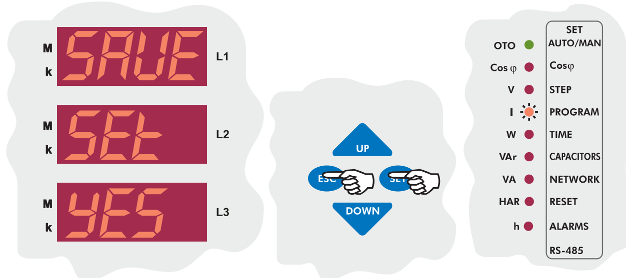
Press **"UP/DOWN"** buttons to select program **(Prog)** menu. In this menu capacitor step's sequence is selected. When program menu is displayed, program led lights.



Press **"SET"** button to select the switching program.



Enter desired program number between 01-10 and press **"SET"** button. If you do not want to set another parameter press **"ESC"** button.



If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

PROGRAM	SEQUENCE
01	linear
02	1.1.1.1...............
03	1.1.2.2...............
04	1.2.2.2...............
05	1.2.3.3...............
06	1.2.4.4................
07	1.1.2.4...............
08	1.2.3.4...............
09	1.2.4.8...............
*10	Capacitor step values are calculated automatically.

* Recommended switching program.

3.5 Switching On&Off and Discharge Time Settings

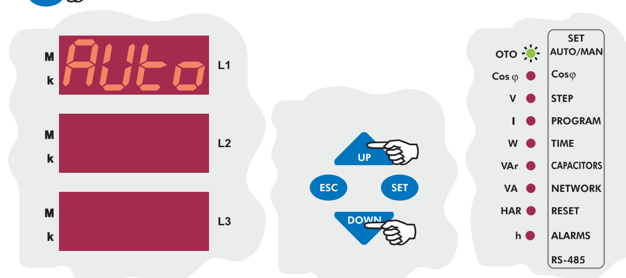
In order to decrease harmful effects of instant reactive power loads to the relays and capacitors, delay time (in terms of seconds) for capacitor steps is entered in this menu.

Note: t-on and t-of time periods must be set according to the system's requirements. If t-on time is set very long, relay can not switch on until the end of this time period and so target compensation ratios can not be achieved.
If t-on time is set too short, capacitor steps switch on&off frequently incase of fast load variations and this causes to shorten the life time of contactors and capacitors. For this reason, it is very important to set these time periods according to your system's requirement.

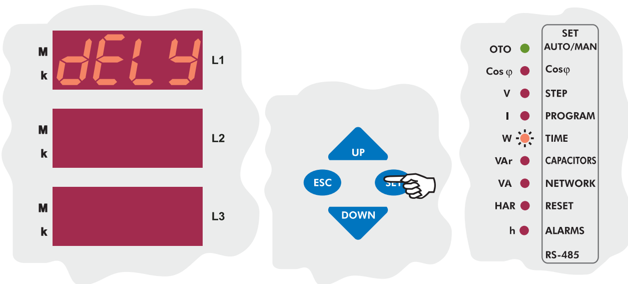
3.5.a Switch-On Delay Time Setting

Switch-on delay time must be set according to system requirement in order to achieve compensation targets and also to provide long life time for contactors and capacitors.

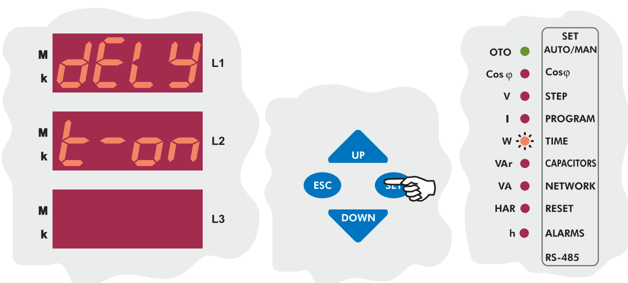
3 sec. Press **"SET"** button for 3 sec. in order to enter to the menu.



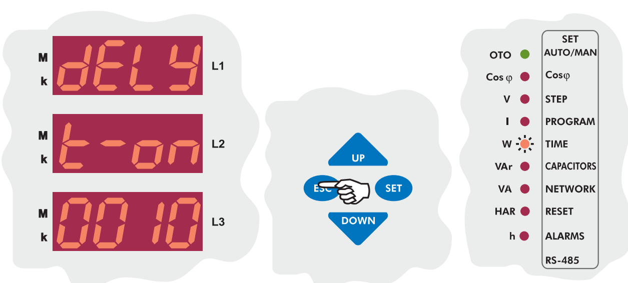
Press **"UP/DOWN"** buttons to select delay time **(dELy)** menu. In this menu switch on&off delay time is set. When delay time menu, is displayed, time led lights.



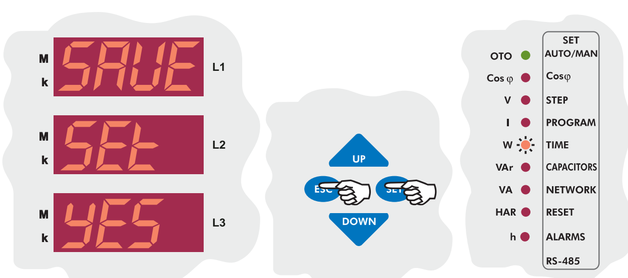
Press **“SET”** button to select **“Delay”** menu.



Press **“SET”** button to set switch on delay time **(dELy t-on)**.



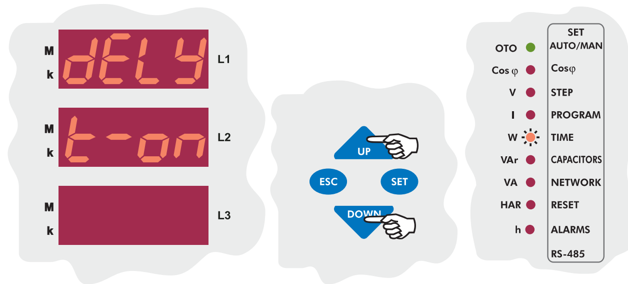
Enter a value between 1-1800 seconds and then press **“SET”** button. If you do not want to set another parameter, press **“ESC”** button.



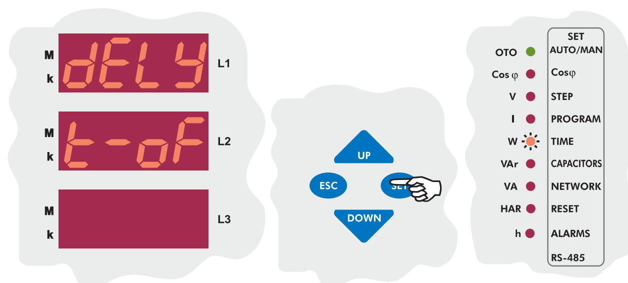
If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

3.5.b Switch-Off Delay Time Setting

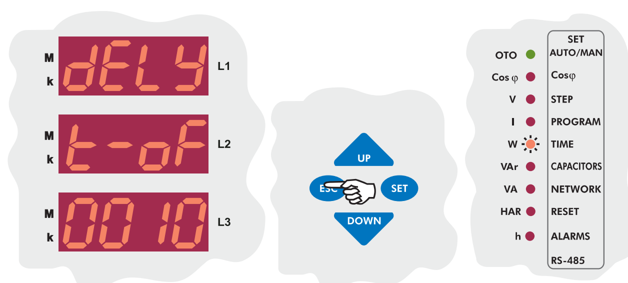
Switch-off delay time must be set according to system requirement in order to achieve compensation targets and also to provide long life time for contactors and capacitors.



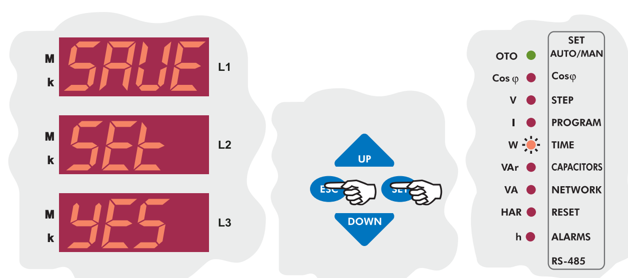
By **“UP/DOWN”** buttons, select switch-off delay time **(dELy t-of)** menu.



Press **“SET”** button to set switch-off delay time.



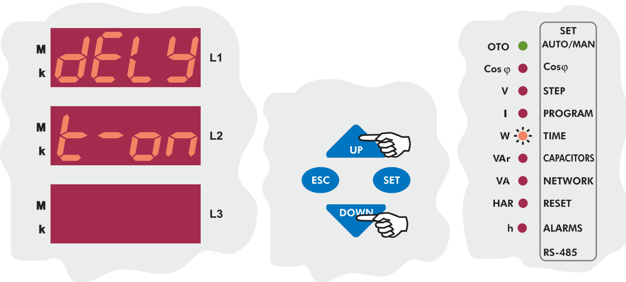
Enter a value between 1-1800 seconds and then press **“SET”** button. If you do not want to set another parameter, press **“ESC”** button.



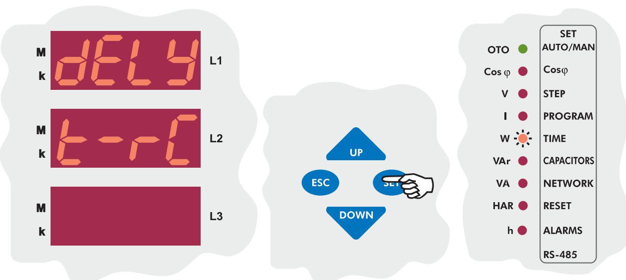
If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

3.5.c Discharge Time Setting

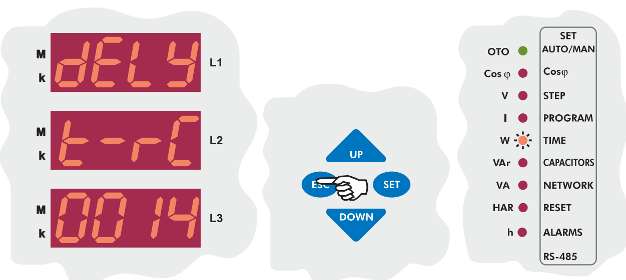
Discharge time must be set according to determined time periods by the capacitor suppliers. If discharge coil or contactors, which have discharge coils, are used, discharge time can be shorten according to do instructions defined by the suppliers.



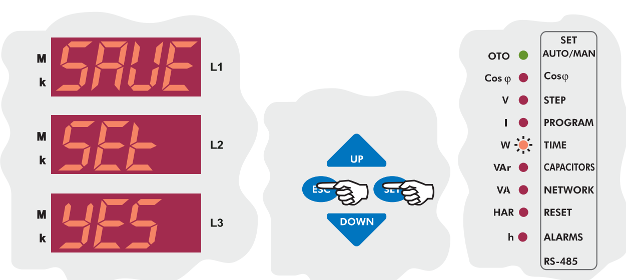
By **"UP/DOWN"** buttons, select discharge time menu **(dELy t-on)**.



Press "SET" button to set discharge time **(t-rC)**.



Enter a value between 1-1800 seconds and then press **"SET"** butto. If you do not want to set another parameter, press **"ESC"** button.



If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.6 Connection Type and Power Value Settings for Capacitors

In this menu, power values and connection types of all capacitor steps are set.

There are 5 different connection types for capacitors which are **"R, S, T, RST** and **off"**. Also capacitor step measurement for power values can be set between 0,02-2,00. If "off" option is selected, there is no need to set any power value.

Note : For first capacitor step, different connection type is impossible and"RST" connection type always must be selected. Because first capacitor step is used to detect correct connection.

Note : If PS-10 program is selected, capacitor powers can be set separately for each capacitor step. However, if any program, except PS-10, is selected, only first capacitor step's power value (C-01) can be set manually. Capacitor powers for other steps are calculated according to the selected program.

3.6.a First Capacitor Step Setting

First capacitor step is used to find connection. For this reason, 3-phase capacitor must be connected to the first step. So, connection setting for first capacitor step is not possible and always **"RST"** connection type is selected.

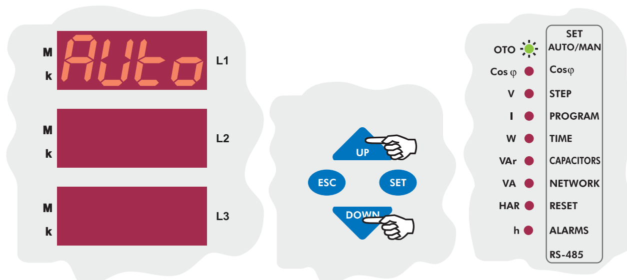
When setup parameter is selected as **"on"** in Auto menu, if any program (except PS-10), is selected, power value of the first capacitor step is measured and other step's power values are calculated according to selected program. When **"Setup:of"** is selected, power values of all capacitor steps (including first capacitor step) can be set manually.

Note : When setup parameter is selected as "on" in Auto menu, after completing the measurement of capacitor powers according to the selected program, RM-12P continues to work in "setup:off" mode.

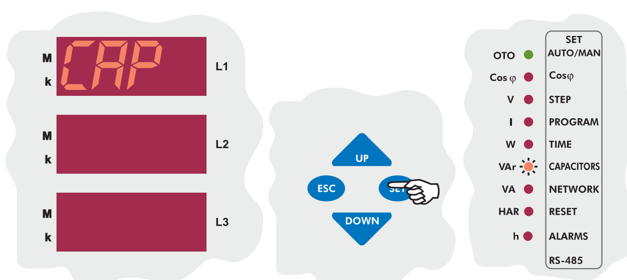
3 sec.



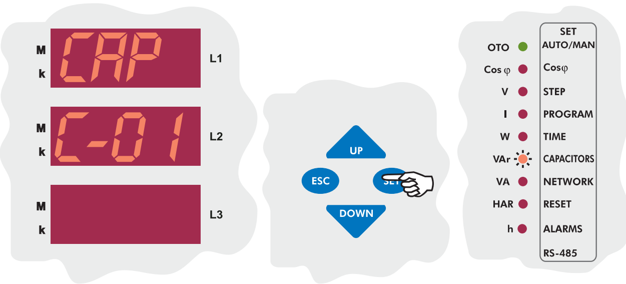
Press **"SET"** button for 3 sec. in order to enter to the menu.



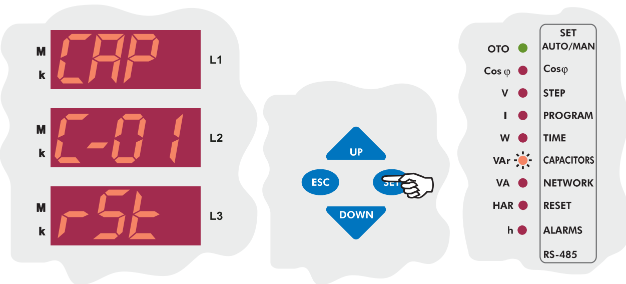
By **"UP/DOWN"** buttons, select capacitor **(CAP)** menu. When capacitor menu is displayed, capacitor **(C/VAr)** led ligths.



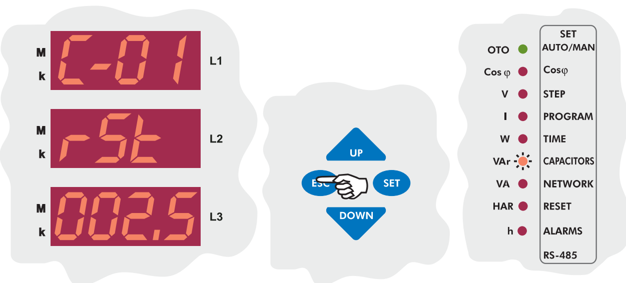
Press **"SET"** button for capacitor settings.



Press **"SET"** button for capacitor settings.

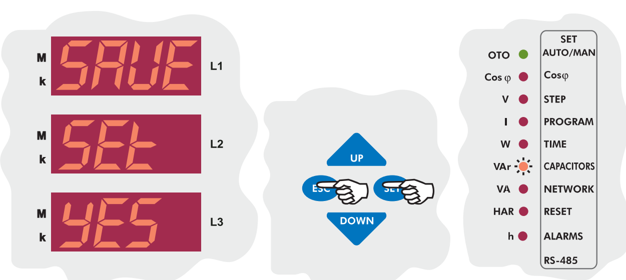


First capacitor step is used to find connection For this reason, 3-phase capacitor connection to first step is a must and also there is not any connection setting for first step. Connection type is selected as **"RST"** and it can not be changed. Press **"SET"** button to set power value of the first capacitor step.



Enter power value of the first capacitor step and then press **"SET"** button. If you do not want to set any parameter, press **"ESC"** button.

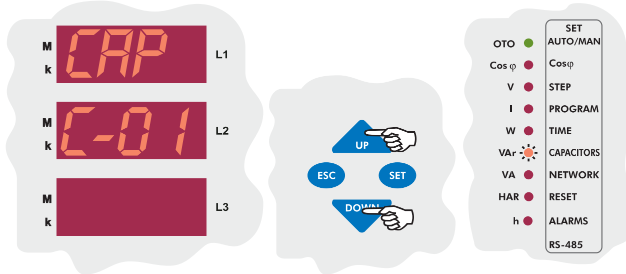
Note : If PS-10 program is selected, capacitor powers can be set separately for each capacitor step. However, if any program (except PS-10) is selected, only first capacitor step's power value (C-01) can be set manually. Capacitor powers of other steps are calculated according to the selected program.



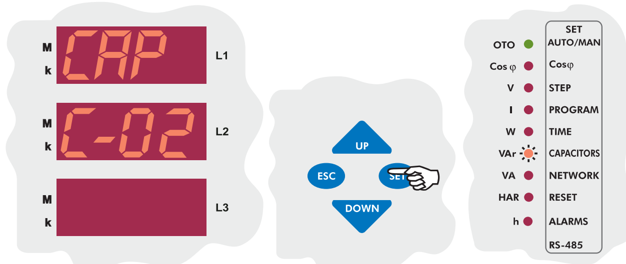
If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.6.b Second Capacitor Step Setting

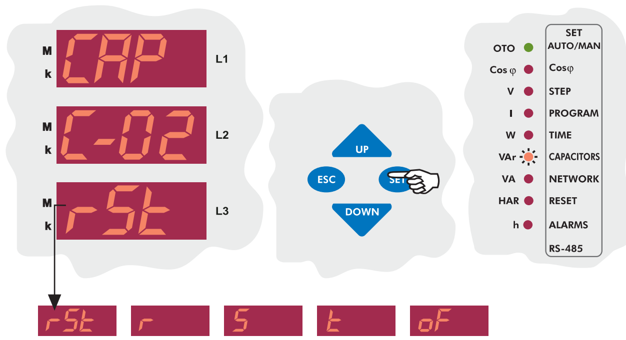
When PS-10 (Program 10) is selected, connection type and capacitor power value settings of all capacitor steps can be selected. When a program (expect PS-10) is selected, only first capacitor step's setting can be done and other steps can not be set but calculated automatically by the device.



By **"UP/DOWN"** buttons, find **"C-02"** menu.



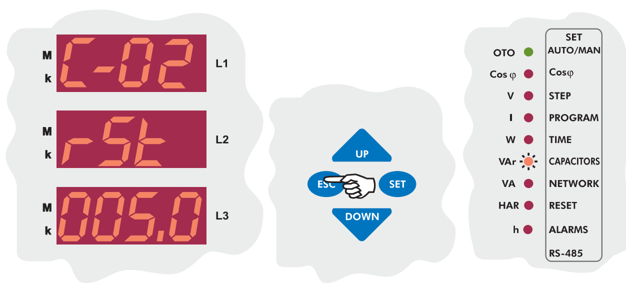
Press **"SET"** button to select connection type.



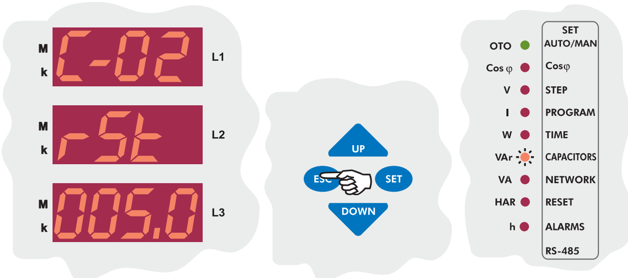
By **"UP/DOWN"** buttons, second capacitor step's connection type can be set as **"r"**, **"S"**, **"t"** or **"rSt"**. If this parameter is selected as **"oF"**, capacitors which are connected to the second step are disabled.

Note : After automatic calculation of the capacitors, if "oF" is displayed in any step, it means that related capacitor could not be calculated, defected or there is no connected capacitors in the related step.

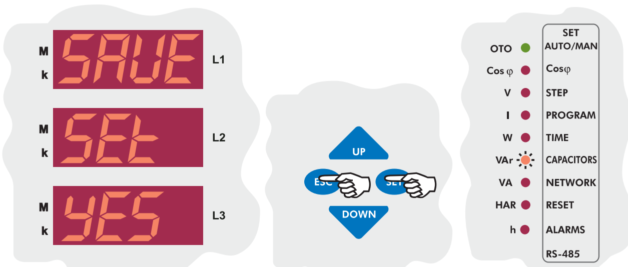
Press **"SET"** button to set second capacitor step value.



Enter power value of the second capacitor step and then press **"SET"** button. If you do not want to set another parameter, press **"ESC"** button.



Enter power value of the second capacitor step and then press **“SET”** button. If you do not want to set another parameter, press **“ESC”** button.



If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

CAP C-03
In this menu, capacitor setting for third step are done.
CAP C-04
In this menu, capacitor setting for fourth step are done.
CAP C-05
In this menu, capacitor setting for fifth step are done.
CAP C-06
In this menu, capacitor setting for sixth step are done.
CAP C-07
In this menu, capacitor setting for seventh step are done.
CAP C-08
In this menu, capacitor setting for eighth step are done.
CAP C-09
In this menu, capacitor setting for nineth step are done.
CAP C-10
In this menu, capacitor setting for tenth step are done.
CAP C-11
In this menu, capacitor setting for eleventh step are done.
CAP C-12
In this menu, capacitor setting for twelveth step are done.

- Above capacitor steps’ settings are done just like second capacitor step (C-02 setting).

3.7 Current and Voltage Transformer Ratio Settings

To obtain accurate power values, current and voltage transformer ratios must be set correctly. If any value was not set as current and voltage transformer ratios, these values are supposed to be **“1”** and capacitor powers will be calculated according to these values.
Current and voltage transformer ratios can be set separately.

3.7.a Current Transformer Ratio Setting

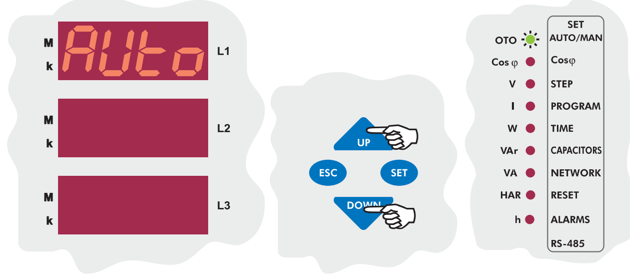
In this menu, current transformer ratio can be set between 1-2000.
For example : For 150/5 current transformer, CT ratio must be set as **“30”**.

Note : Take care that this value must be the ratio not CT primary or secondary value.

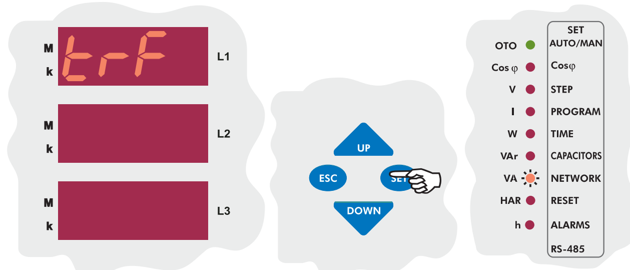
3 sec.



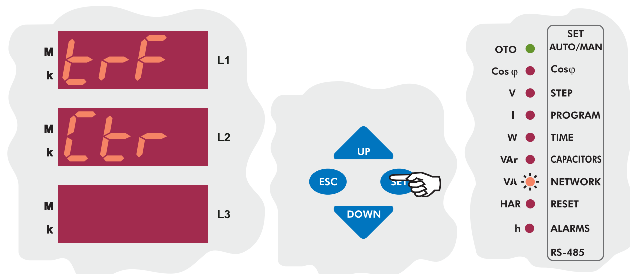
Press **“SET”** button for 3 sec. in order to enter to the menu.



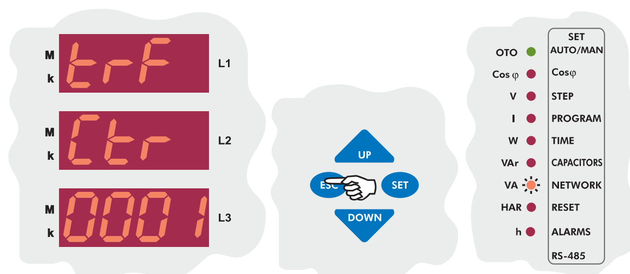
By **“UP/DOWN”** buttons, find current and voltage transformer ratio menu **(trF)**. When this menu is selected, transformer **(VA/TRF)** led lights.



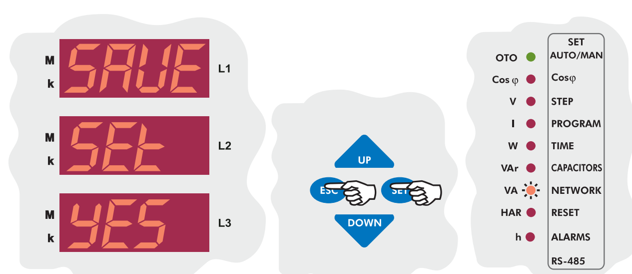
Press **“SET”** button to set CT and VT ratios.



Press **“SET”** button to set CT ratio.



Enter CT ratio between 1-2000 and press **“SET”** button. If you do not want to set another parameter, press **“ESC”** button.

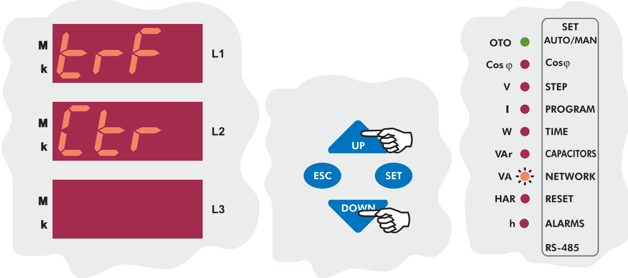


If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

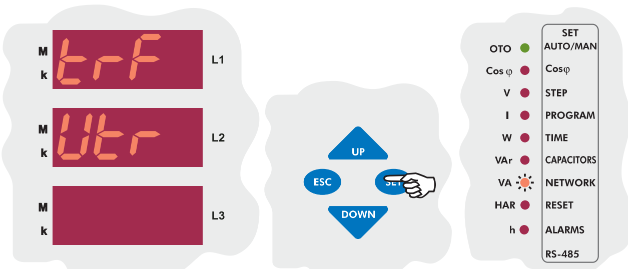
3.7.b Voltage Transformer Ratio Setting

In this menu, voltage transformer ratio is set between 1-2000. For example: For 34,5 kV / 100 V transformer, VT ratio must be set as **"345"**.

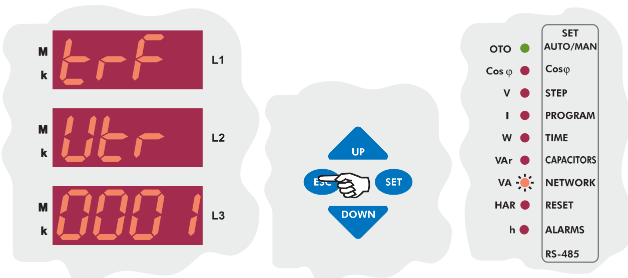
Note : Take care that this value must be ratio but not VT primary or secondary value.



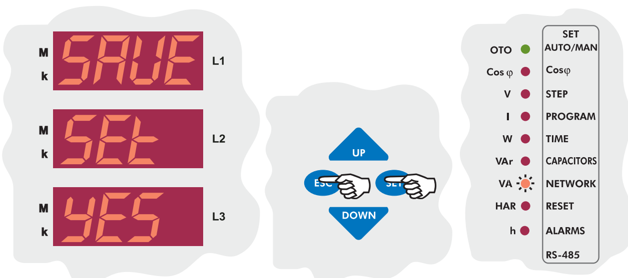
By **"UP/DOWN"** buttons, find voltage transformer ratio (Vtr) menu.



Press **"SET"** button to set VT ratio.



Enter VT ratio between 1-2000 and press **"SET"** button. If you do not want to set another parameter, press **"ESC"** button.

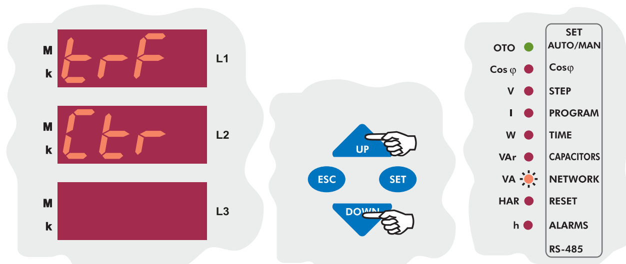


If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

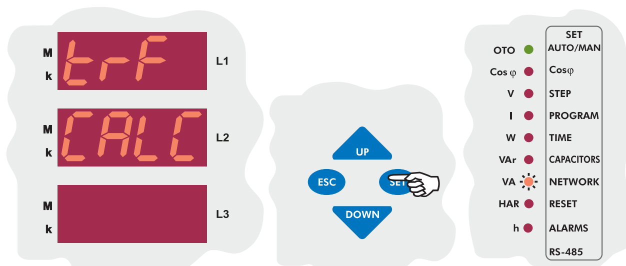
3.7.c Reactive Energy Calculation Method Setting

Three different methods exist for reactive energy calculation in RM-12P. Brief informations about these methods are explained in below table. Related values which must be entered in the menu are also indicated in the table in order to select reactive power calculation methode for mechanical and digital energymeters.

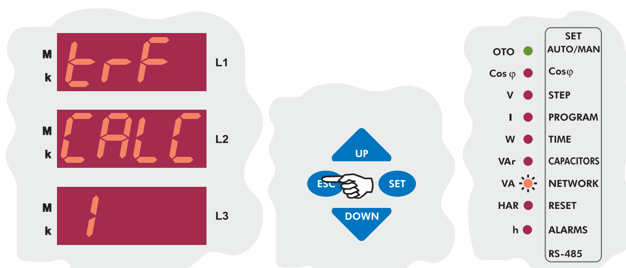
Mechanical Energymeter (Vectorel summation of 3-phase)	Digital Energymeter (Each phase separately)	Reactive Energy (Q)	Description
0	1	90° rotation of voltage vector and multiply with current	It is the most preferred reactive power calculation methode.
2	3	$\sum_{n=1}^{\infty} V_n.I_n.\sin(\varphi_n)$	Total value of the multiplication of V_n and I_n values up to 19 th harmonics. This calculation method is mostly preferred for network analysers.
4	5	$\sqrt{S^2-P^2}$	Power Triangle Method : According to this method; $Q=\sqrt{S^2-P^2}$ (Q : Reactive power, S : Active power, P : Apparent power)



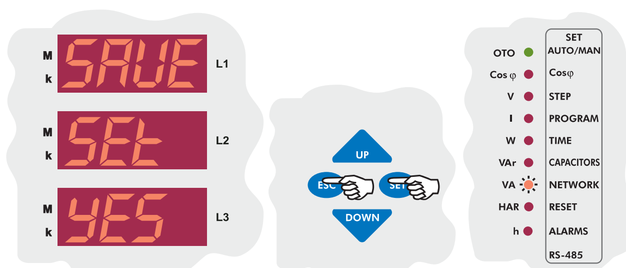
By **"UP/DOWN"** buttons, find reactive energy calculation method **(CALC)**.



Press **"SET"** button to select calculation method.



In order to select reactive energy calculation method (for mechanical and digital energymeter), enter a value between 0-5 and press **"SET"** button. If you do not want to set another parameter, press **"ESC"** button.



If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.8 Reset Settings

In this menu, alarms, ratios (reactive/active ratios) and energymeters are reset.

3.8.a Alarm Reset Setting

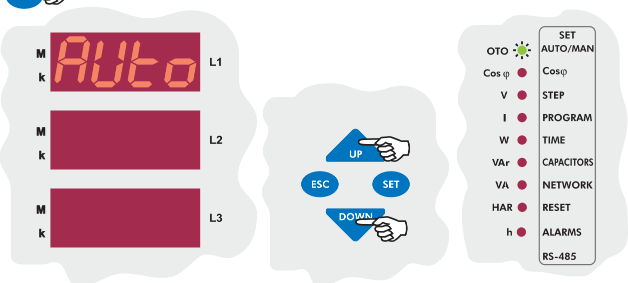
While device operates, existing alarms are reset in this menu by selecting **"yES"** option.

Note : When an alarm exists, alarm relay switches on. Also related led lights and alarm code is displayed. Even if alarm conditions do not exist, alarm relay still switches on. In reset menu, alarms are reset and so alarm relay is switched off. If alarm conditions still exist, even if alarms are reset in the "reset" menu, alarm relay switches on again. If alarm conditions does not exist, alarm relay continues,to its normal operation.

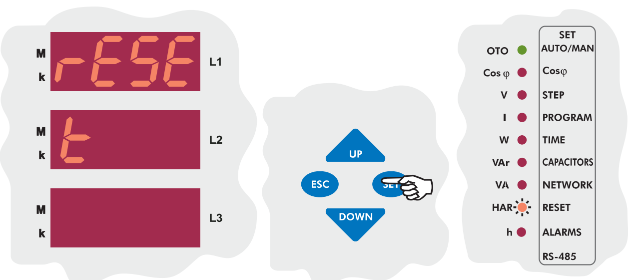
3 sec.



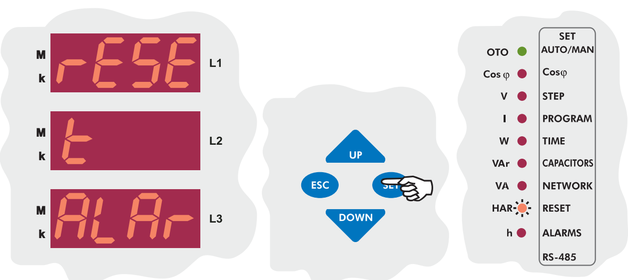
Press **"SET"** button for 3 sec. in order to enter to the menu.



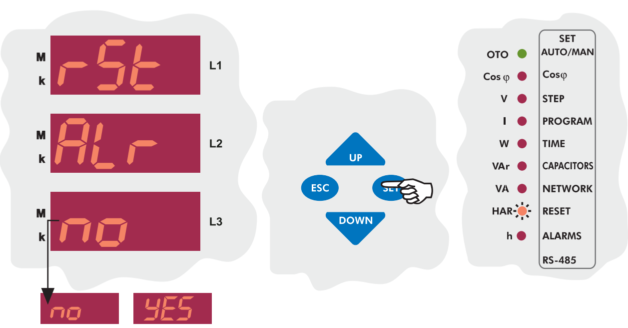
By **"UP/DOWN"** buttons, find **"reset"** menu. When reset menu is selected, reset led lights.



Press **"SET"** button for reset settings.



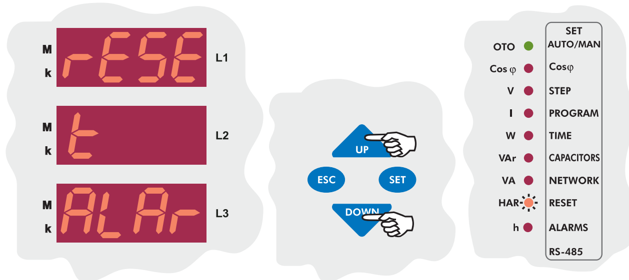
Press **"SET"** button for alarm settings.



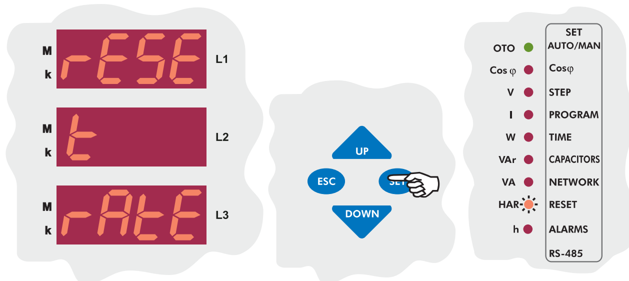
By **"UP/DOWN"** buttons, select **"yES"** to delete alarm values or **"no"** to cancel the delete process and then press **"SET"** button.

3.8.b Reactive/Active Ratio Reset Setting

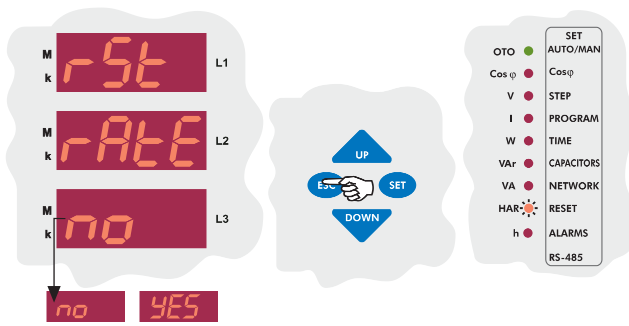
In this menu, reactive/active ratio, which is calculated by device, is reset.



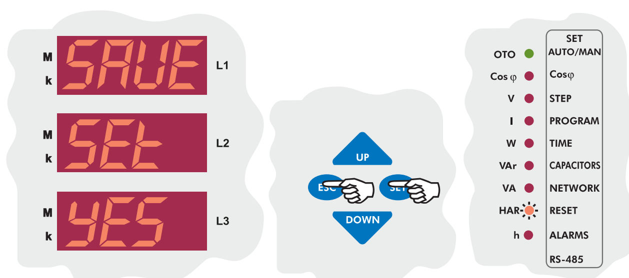
By **"UP/DOWN"** buttons, find "reactive/active ratio reset" **(rAtE)** menu.



Press **"SET"** button for "reactive/active ratio reset" settings.



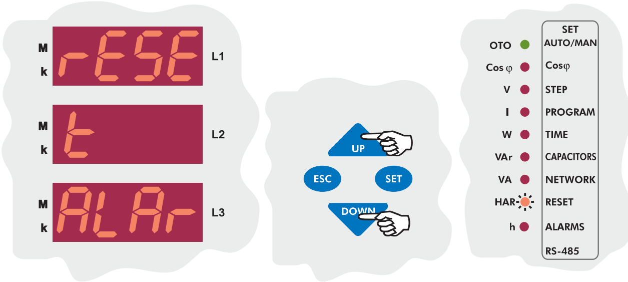
By **"UP/DOWN"** buttons, select, **"yES"** to delete reactive/active ratio or **"no"** to cancel the delete process and then press **"SET"** button.



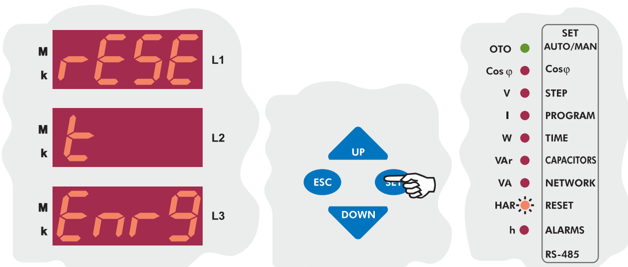
If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.8.c Energy Counter Reset Setting

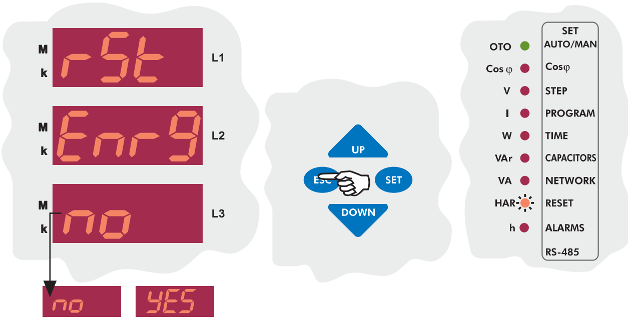
In this menu, energy counters are reset.



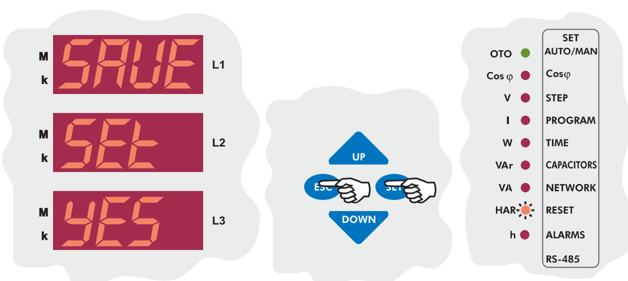
By **"UP/DOWN"** buttons, find energy counter reset menu.



Press **"SET"** button for energy counter settings.



By **"UP/DOWN"** buttons, select **"yES"** to delete reactive/active ratio or **"no"** to cancel the delete process and then press **"SET"** button.



If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.9 Alarm Settings

In this menu, alarm values for over **voltage, reactive/active ratio, *temperature** and **THD** can be set saparately.
Device has 2 relay outputs (except capacitor step relays).wihc are alarm relay and *fan relay.
If any mentioned alarm condition (except temperature) exists, alarm relay switches on and also related error led and alarm led (🔈) light. (Refer to "errors" section for details)
Also related error code is displayed. (Refer to page 30 for alarm codes)

* Optional

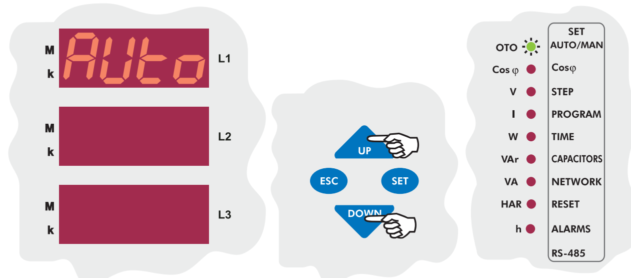
3.9.a Over Voltage Alarm Setting

In this menu, over voltage alarm values are Preset. Entered also value consists of 3-phase. If any phase value exceeds the set value and also alarm condition still exists even if entered delay time is over, alarm relay switches on and also over voltage led (**V>**) lights.

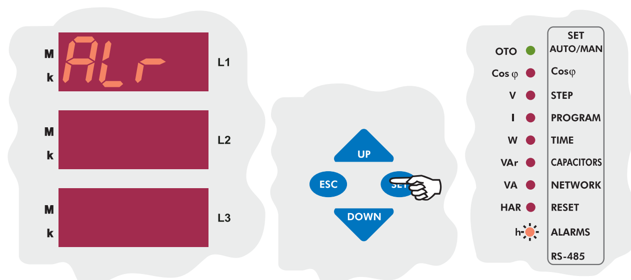
3.9.a.a Over Voltage Setting

In this menu, over voltage value is set between 0-300 V (for Vtr=1).
If this value is set as **"0"**, this function is disabled.

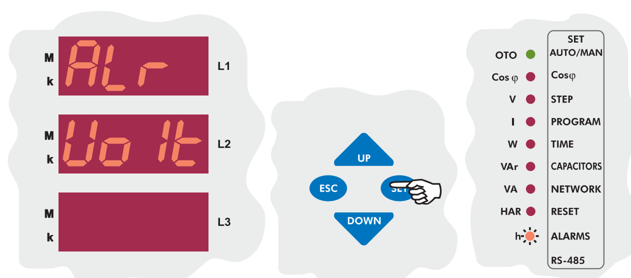
3 sec. Press **"SET"** button for 3 sec. in order to enter to the menu.



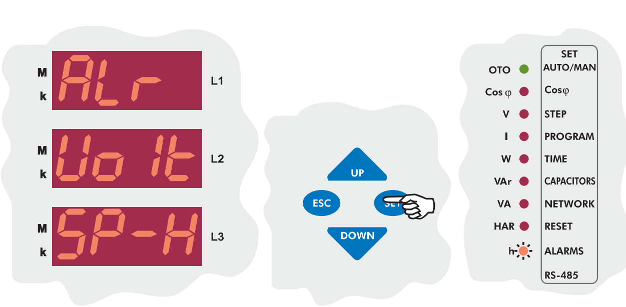
By **"UP/DOWN"** buttons, find Alarm **(ALr)** menu. When Alarm menu is selected, alarm led lights.



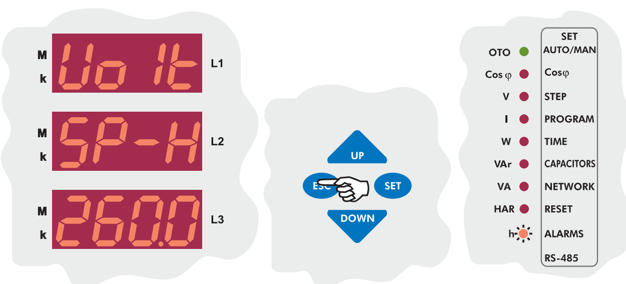
Press **"SET"** button for voltage settings.



Over voltage value **(SP-H)**, delay time **(dELy)** and over voltage step **(StEP)** parameters can be set in this menu. In order to set these parameters, press **"SET"** button.

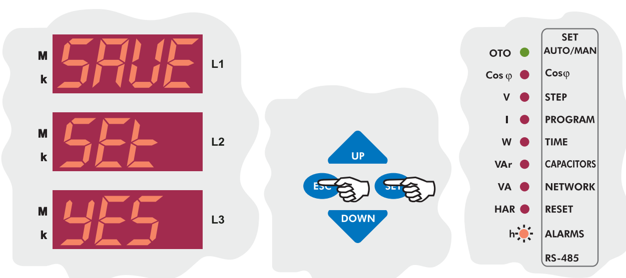


Press **"SET"** button for over voltage (SP-H) settings.



Enter the over voltage value between 0-300 V and if you want to set another parameter, press **"SET"** button otherwise press **"ESC"** button.

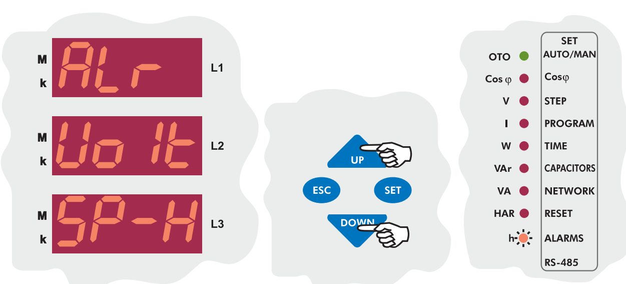
Note : If over voltage value is set as "0", this function is disabled.



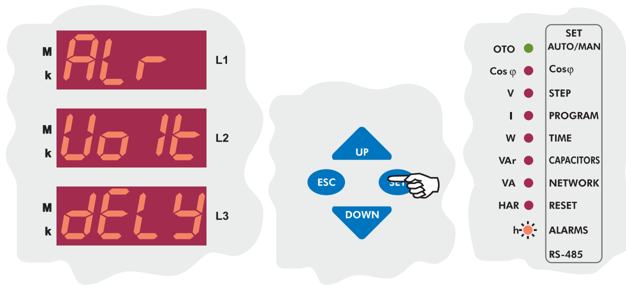
If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.9.a.b Over Voltage Delay Time Setting

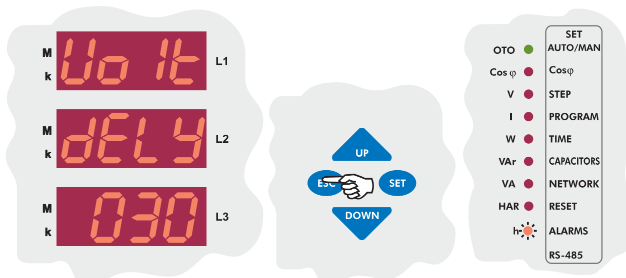
If one or more phase voltage value exceeds preset voltage value,an alarm occurs at the end of adjusted delay time. Delay time can be set between 0-250 seconds.



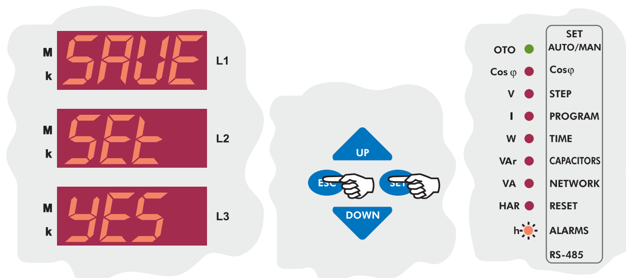
Press **"DOWN"** button to set over voltage delay time **(dELy)** menu.



Press **"SET"** button to set delay time.



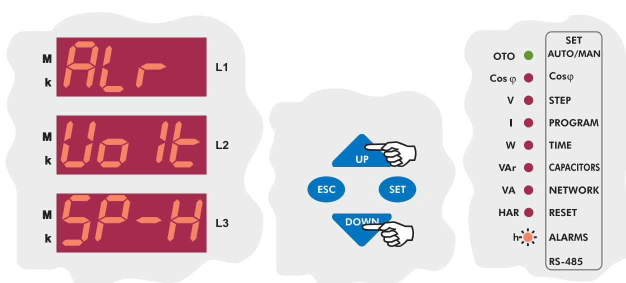
Enter the over voltage delay time between 0-250 seconds and if you want to set another parameter press **"SET"** button otherwise press **"ESC"** button.



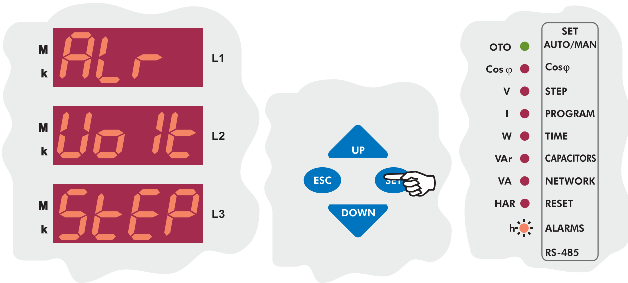
If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.9.a.c Switch On&Off Setting for Over Voltage Alarm Setting

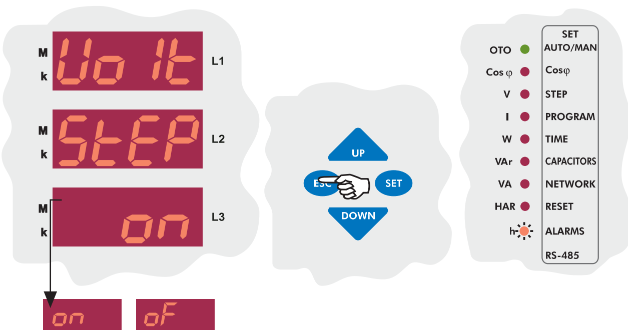
In order to protect the capacitors from over voltage, when an over voltage alarm occurs, capacitor's switch on&off settings are done in this menu. If **"on"** is selected, when over voltage error occurs, capacitor steps switch on.
If **"off"** is selected, when over voltage error occurs, capacitor steps switch off.



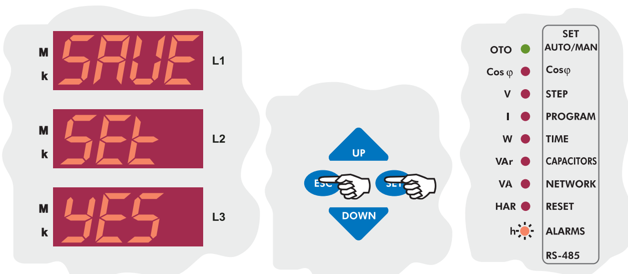
Press **"DOWN"** button, in order to pass from over voltage menu to the over voltage step **(StEP)** menu.



Press **"SET"** button for capacitor step settings.



By **"UP/DOWN"** buttons, select **"on"** or **"off"** option and press **"SET"** button. If you do not want to set another parameter, press **"ESC"** button.



If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.9.b Reactive / Active Ratio Setting

If reactive/active ratio exceeds preset value, an alarm occurs. This ratio can be set for inductive/active and capacitive/active separately between 0-99 %. When capacitive/active ratio of the network exceeds preset value, an alarm occurs. If this value is set as "0", this function is disabled.

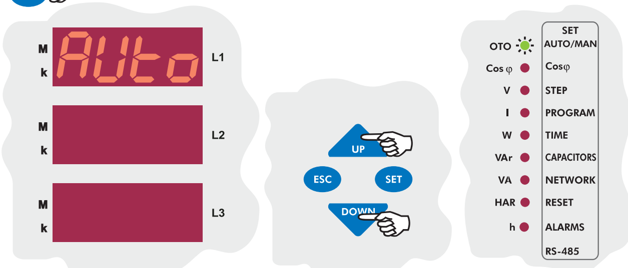
3.9.b.a Capacitive Ratio Setting

In order to provide accurate compensation, high set value of capacitive/active ratio is set in this menu. This value can be set between 0-99 %. When capacitive/active ratio of the network exceeds preset value, an alarm occurs. If this value is set as "0", this function is disabled.

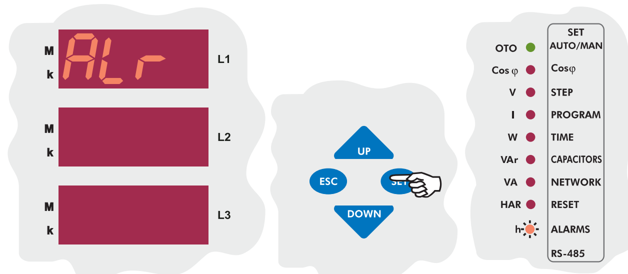
3 sec.



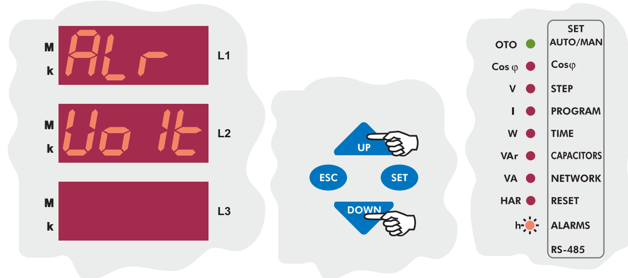
Press **"SET"** button for 3 sec. in order to enter to the menu.



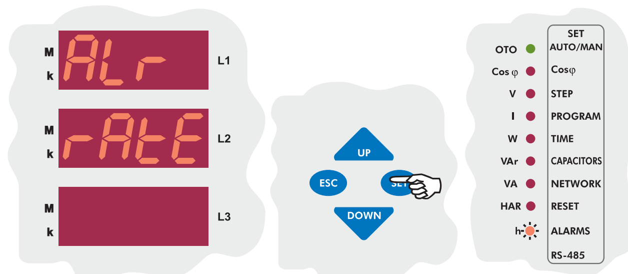
By **"UP/DOWN"** buttons, find Alarm **(Alr)** menu. When **"Alarm"** menu is selected, alarm led lights.



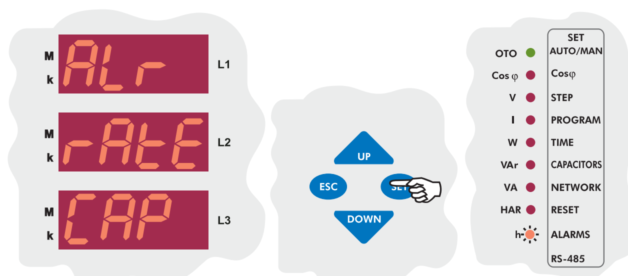
Press **"SET"** button for alarm settings.



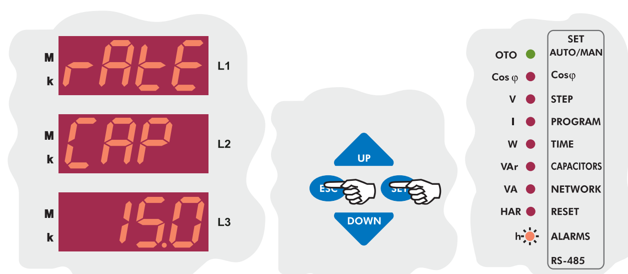
By **"UP/DOWN"** buttons,find reactive/active ratio **(rAtE)** menu.



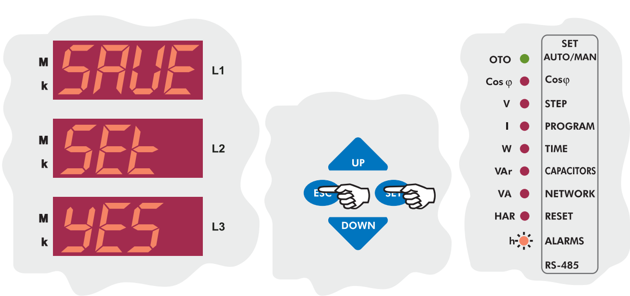
Press **"SET"** button for capacitive/active and inductive/active ratio settings.



Press **"SET"** button to set capacitive/active ratio.



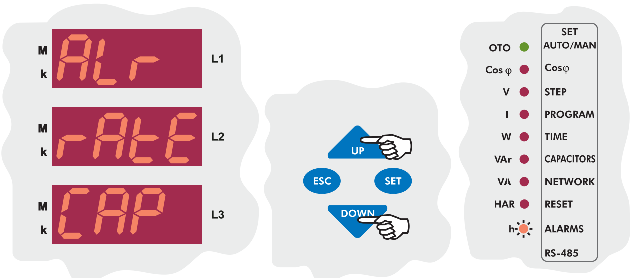
Enter the capacitive/active ratio between 0-99 % and press **"SET"** button, press **"ESC"** button, if you do not want to set another parameter.



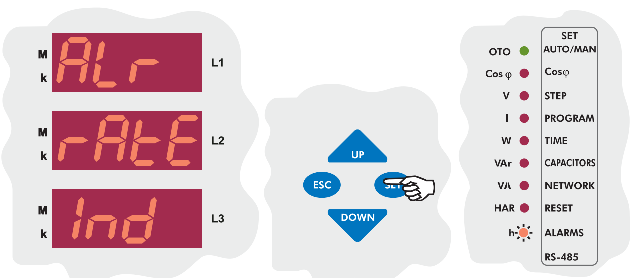
If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

3.9.b.b Inductive Ratio Setting

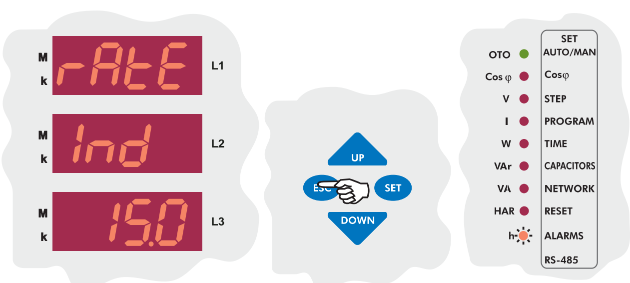
In order to provide accurate compensation, high set value of inductive/active ratio is set in this menu. This value can be set between 0-99 %. When inductive/active ratio of the network exceeds preset value, an alarm occurs. If this value is set as **“0”**, this function is disabled.



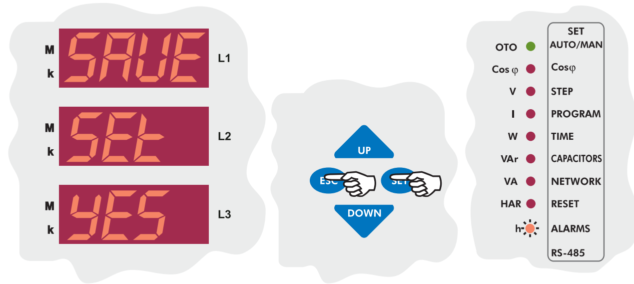
When **“Alr rAtE CAP”** is displayed, find **“rAtE Ind”** menu by using **“UP/DOWN”** buttons.



Press **“SET”** button for inductive/active ratio settings.



Enter the inductive/active ratio between 0-99 % and press **“SET”** button. If you do not want to set another parameter, press **“ESC”** button.



If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

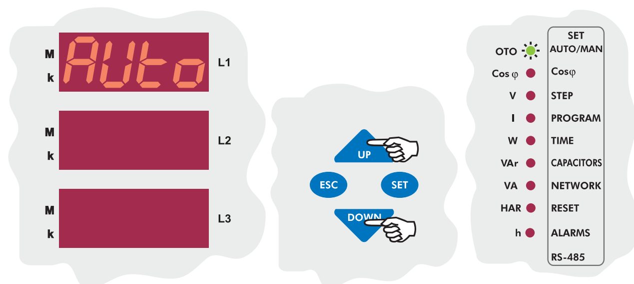
3.9.c Temperature Alarm Settings

Note : Temperature measurement feature is optional for RM-12P.
In order to protect the capacitors from over temperature, high (HEAt SP-H), low (HEAt SP-L) set values between “00.0-99.9 °C” and step protection (HEAt StEP) are programmed in this menu. After a 10 sec. increasing of the high value of the temperature, which is programmed in the device, RM-12P gives an alarm signal (Erro r-10); according to selected step value (HEAt STEP) relays going to be switched-off or keep remained. After the temperature decrease the lower limit then alarm situation is disabled.

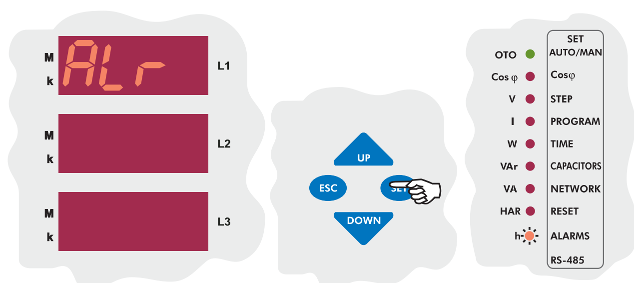
3.9.c.a Programming the Hihg Limit of Temperature Alarm

Enabling the alarm relays according to high value of temperature is programmed in this menu. This value can be programmed between “00.0-99.9 °C”.
(Refer to “Technical Features” section for measurement ranges)

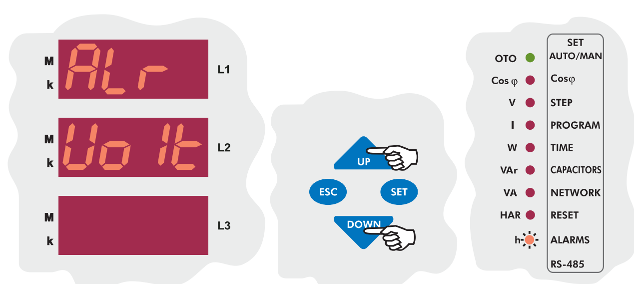
3 sec. Press **“SET”** button for 3 sec. in order to enter to the menu.



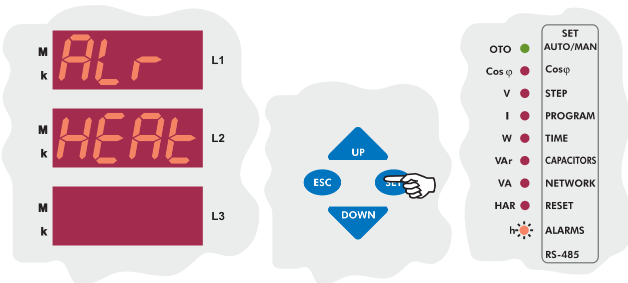
By **“UP/DOWN”** buttons, find “Alarm” **(ALr)** menu. When “Alarm” menu is selected, alarm led lights.



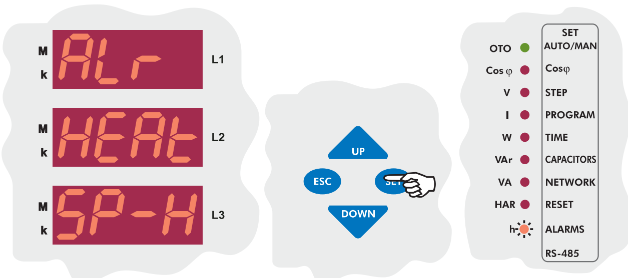
Press **“SET”** button for alarm settings.



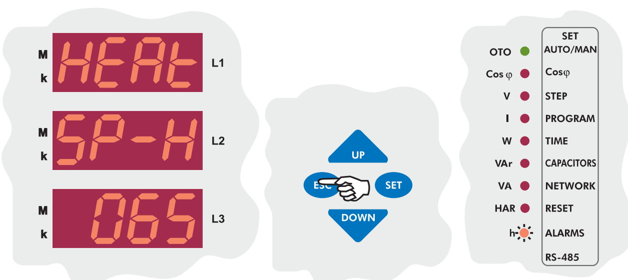
By **“UP/DOWN”** buttons, find fan relay (HEAT) menu.



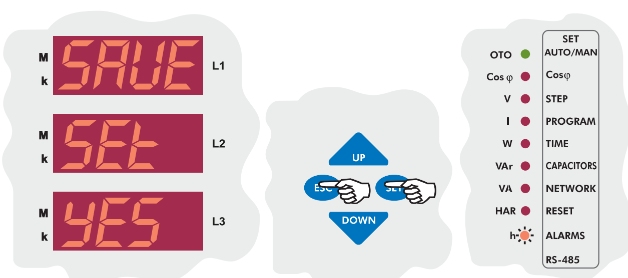
Press **"SET"** button to select **"SP-H"** parameter for high set value settings.



Press **"SET"** button to select high set value of temperature (SP-H).



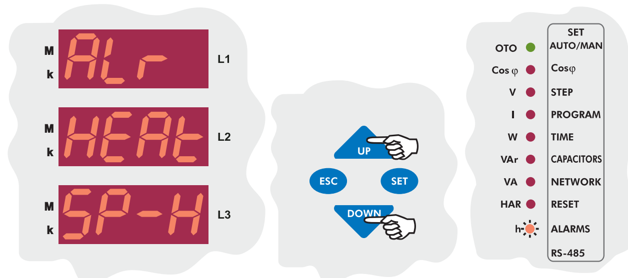
Enter a value between "00.0-99.9 °C" and press **"SET"** button. If you do not want to set another parameter, press **"ESC"** button.



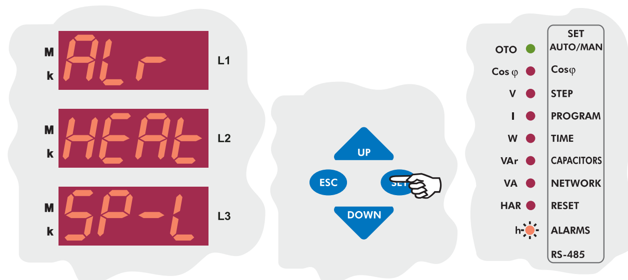
If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.9.c.b Disabling the Temperature Alarm

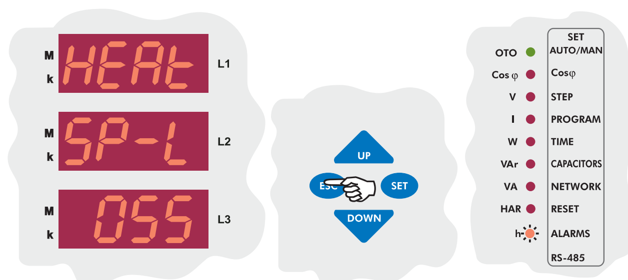
In order to switch off the fan relay, low set value of temperature is set in this menu. This value can be set between "00.0-99.9 °C" .
(Refer to "Technical Features" section for measurement ranges)



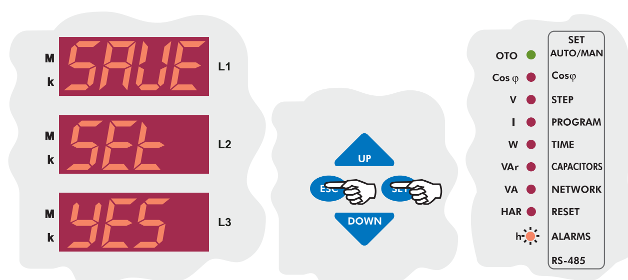
When **"ALr HEAt SP-H"** is displayed, find low setvalve of temperature value **(SP-L)** by using **"UP/DOWN"** buttons.



Press **"SET"** button to set low setvalve of temperature **(SP-L)**



Enter the low setvalve temperature between 0-99 °C and press **"SET"** button. If you do not want to set another parameter, press **"ESC"** button.

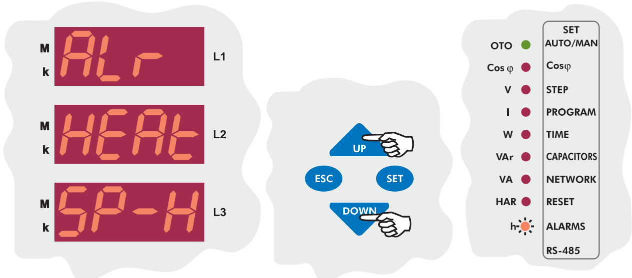


If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

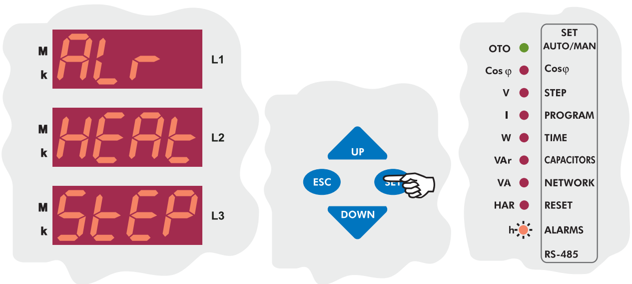
3.9.c.c Switch On&Off Settings for Temperature Alarm

In order to protect the capacitors from over heat, when over temperature alarm occurs, capacitor's switch on&off setting are done.

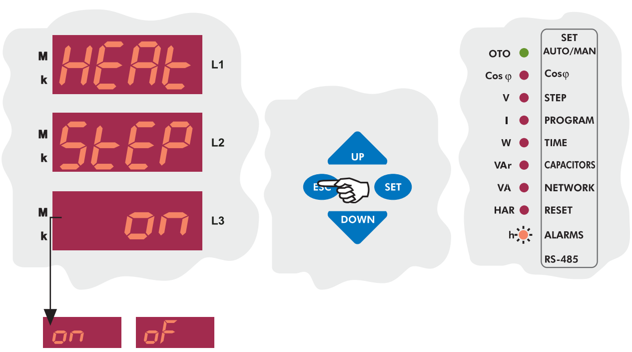
If **"on"** option is selected, when over temperature alarm occurs, capacitor steps switch on.
If **"of"** option is selected, when over temperature alarm occurs, capacitor steps switch off.



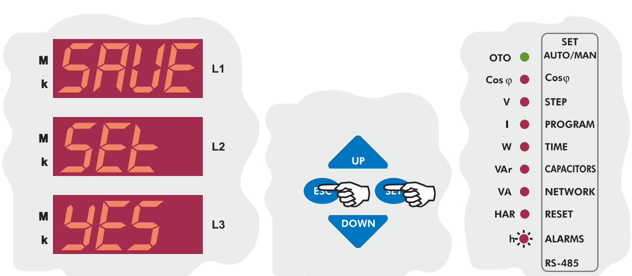
When **"ALr HEAt SP-H"** is displayed, find **"STEP"** parameter by using **"UP/DOWN"** buttons.



Press **"SET"** button for capacitor's switch on&off settings.



By **"UP/DOWN"** buttons, select **"on"** or **"of"** option and press **"SET"** button. If you do not want to set another parameter, press **"ESC"** button.



If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

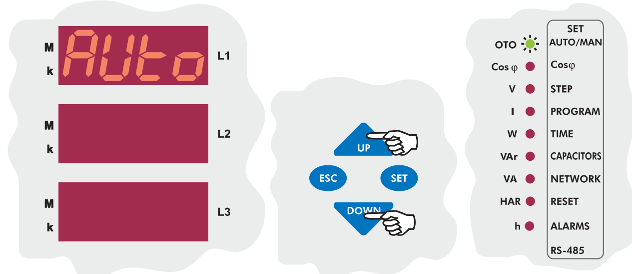
3.9.d Harmonic Setting

If total harmonic value of measured voltages exceeds preset value and also if this value does not turn to normal level during delay time, alarm relay switches on and harmonic led (ᴹᴡ) lights.

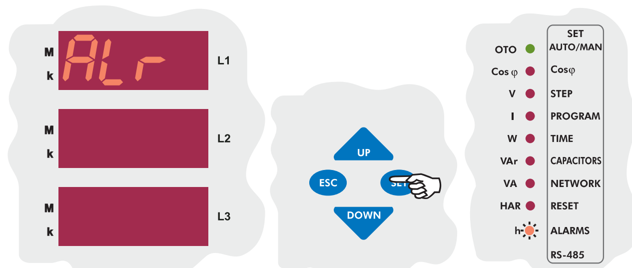
3.9.d.a Over Voltage Harmonic Setting

High setpoint value of voltage total harmonic value is set in this menu.

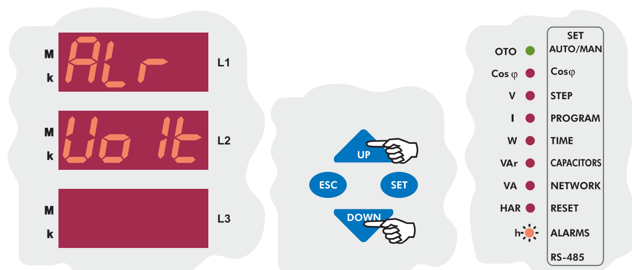
3 sec. Press **"SET"** button for 3 sec. in order to enter to the menu.



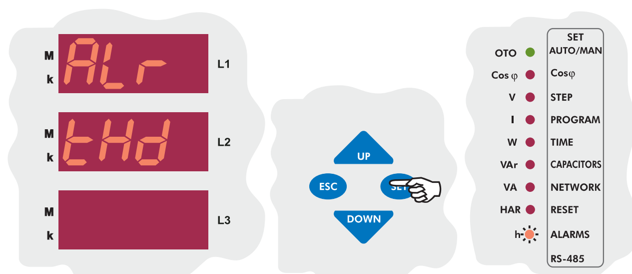
By **"UP/DOWN"** buttons, find "Alarm" **(ALr)** menu. When "Alarm" menu is selected, alarm led lights.



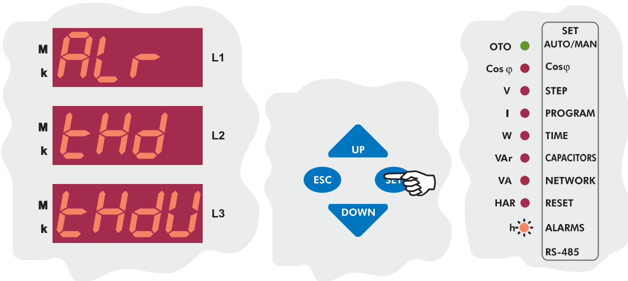
Press **"SET"** button for alarm **(ALr)** settings.



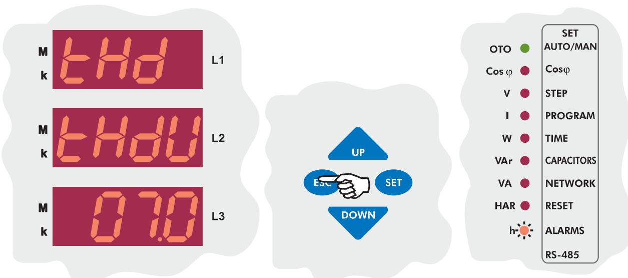
By **"UP/DOWN"** buttons, find over voltage harmonic **(tHd)** menu.



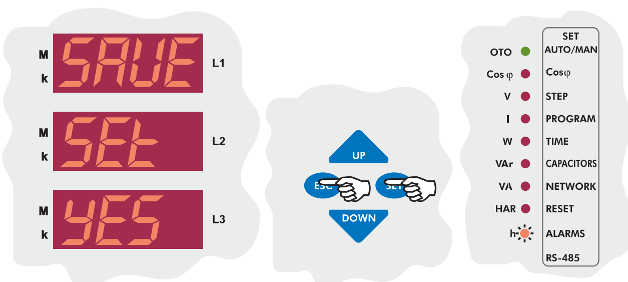
In this menu, over voltage harmonic value **(tHdV)**, delay time **(dELy)** and capacitor step **(StEP)** parameters are set. In order to set these parametesers, press **"SET"** button.



Press **"SET"** button to set over voltage harmonic **(thdV)** value.



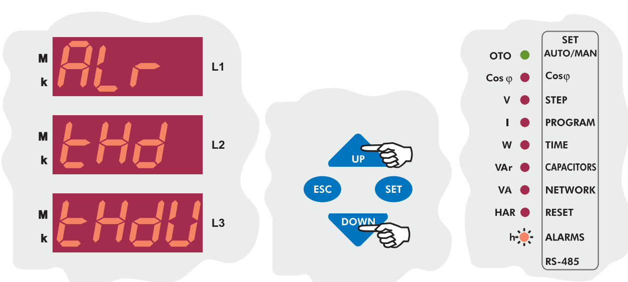
Enter the over voltage harmonic value between 0-99 % and press **"SET"** button.



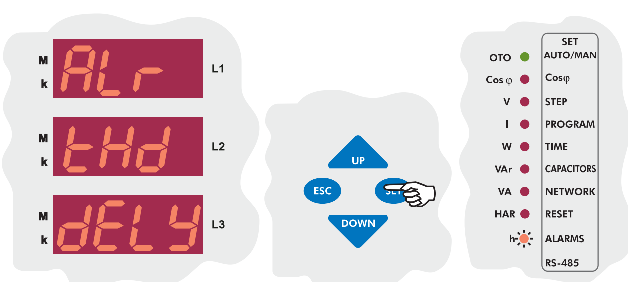
If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.9.d.b Harmonic Alarm Delay Time Setting

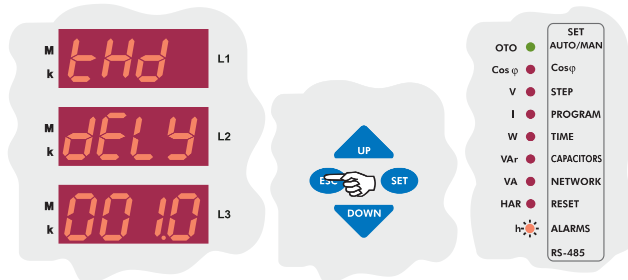
If total voltage harmonic value exceeds preset value and it does not turn to normal level during delay time, an alarm occurs.



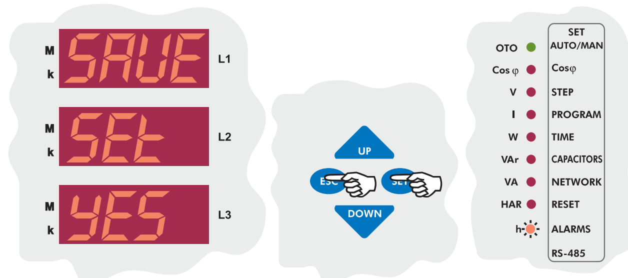
By **"UP/DOWN"** buttons, find delay time **(dELy)** menu.



Press **"SET"** button for delay time settings.



Enter the delay time for over voltage harmonic between 0-999,9 seconds and press **"SET"** button.

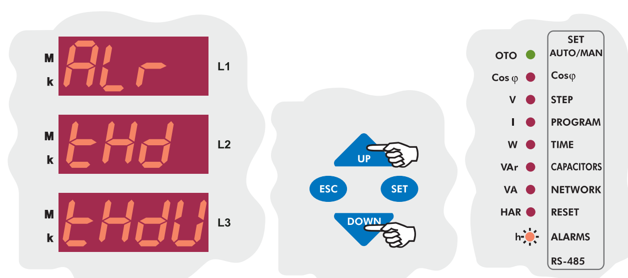


If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

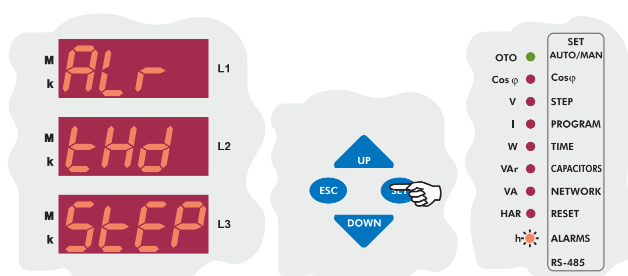
3.9.d.c Switch On&Off Settings for Harmonic Alarm

In order to protect the capacitors from over voltage harmonic, switch on&off settings are done in this menu.

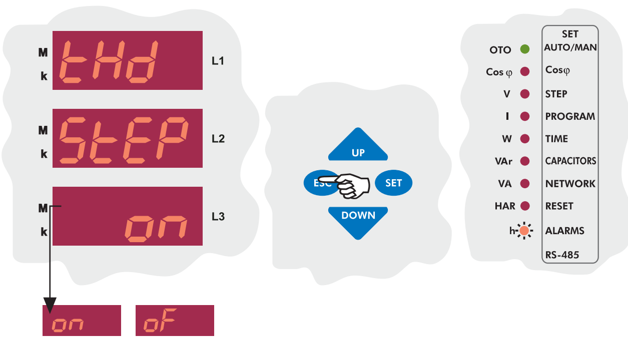
If **"on"** option is selected, when over voltage harmonic error occurs, capacitor steps still switch on.
If **"of"** option is selected, when over voltage harmonic error occurs, capacitor steps switch off.



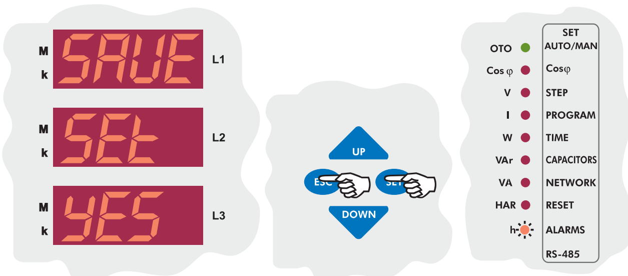
By **"UP/DOWN"** buttons, find capacitor step **(StEP)** menu.



Press **"SET"** button for capacitor step settings.



By **"UP/DOWN"** buttons, select **"on"** (capacitors switch on) or **"of"** (capacitors switch off) option and press **"SET"** button. If you do not want to set another parameter, press **"ESC"** button.



If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.10 Fan Relay Settings

Switching-on and Switching-off values are defined in this menu. There are two submenus as "FAn on" and "FAn oFF" for this feature.

<u>**Note:**</u> **RM-12P temperature measurement feature is optional.**

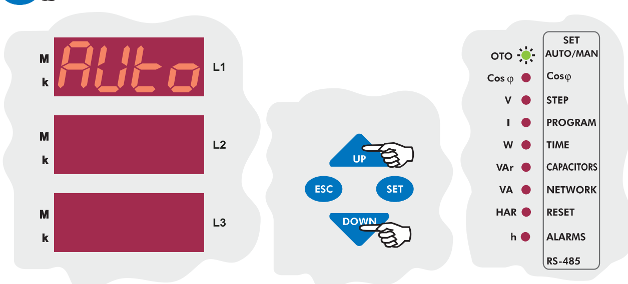
3.10.a Fan Relay Switched-on Value

Fan relay operating temperature is defined in this menu. Relay is switched on after 10 sec. when the measured temperature increase the set value and Fan led light will be on.

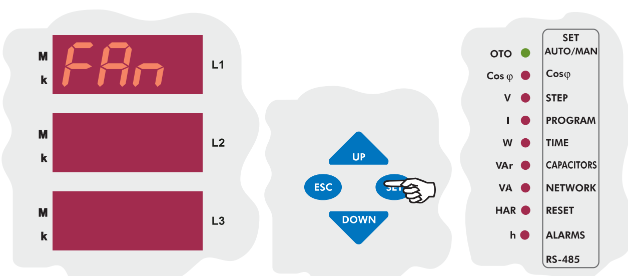
3 sec.



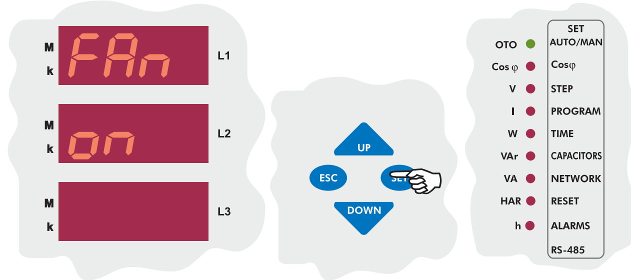
Press **"SET"** button for 3 sec. in order to enter to the menu.



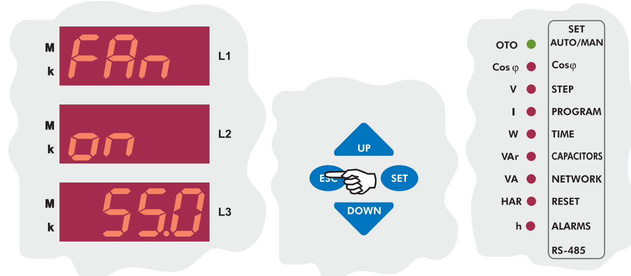
By **"UP/DOWN"** buttons, find fan relay settings **(FAn)** menu.



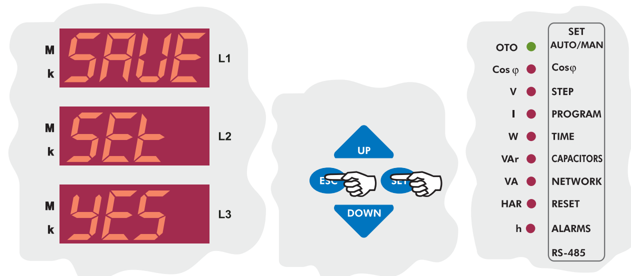
First parameter is the operating temperature of the fan. Press **"SET"** button to enter the settings.



Press **"SET"** button to program the operating temperature.



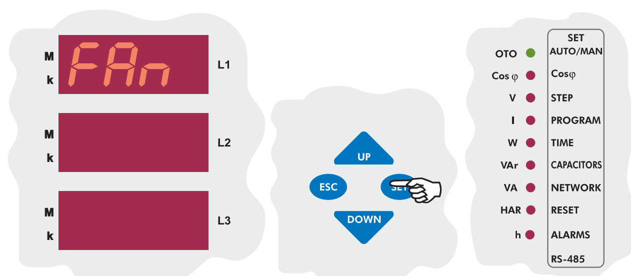
Press **"SET"** button to enter the temperature alarm between "00.0-99.8" °C.



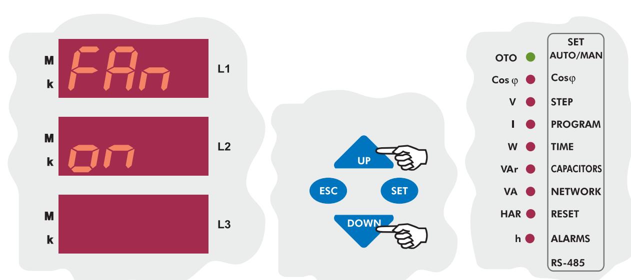
If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.10.b Fan Relay Switching-off Value

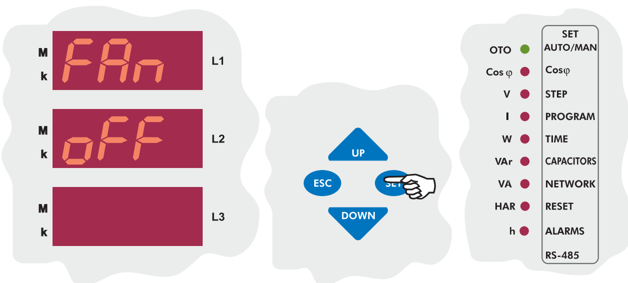
Fan relay switching-off temperature is defined in this menu.



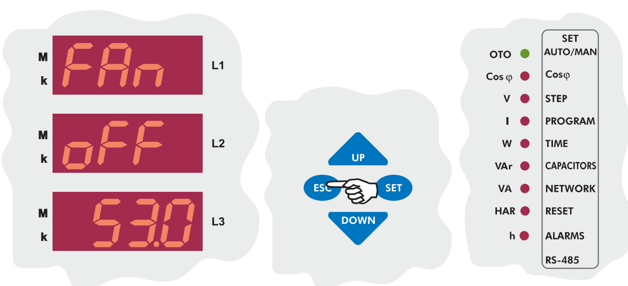
First parameter is the operating temperature of the fan. Press **"SET"** button to enter the settings.



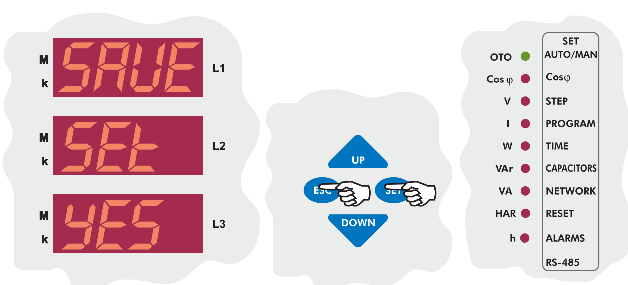
By **"UP/DOWN"** buttons, find "FAn oFF" menu as a second parameter.



Press **"SET"** button for disabling the temperature protection.



Press **"SET"** button to enter the temperature alarm between "00.0-99.8" °C.
(Higher value than "FAn on" value can not be programmed)



If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.11 Computer Communication Settings (RS-485)

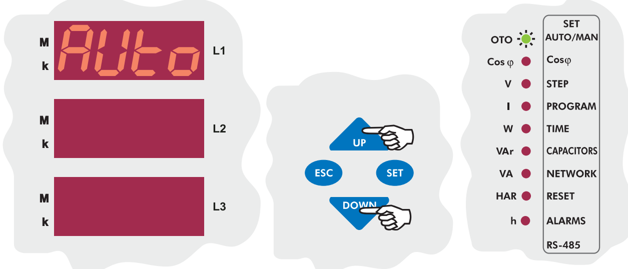
RM-12P has MODBUS-RTU protocol on RS-485 communication port in order to communicate with the computer. All measured parameters can be saved into computer's memory via appropriate software. All necessary configurations also can be set via software.

Note : Computer communication feature is only available for RM-12P model.

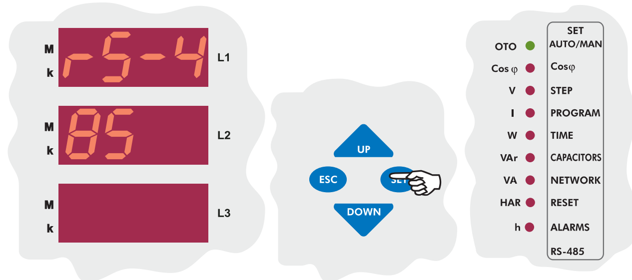
3.11.a Device Address Setting

Computer communication can be achieved up to 247 devices via device adress setting.

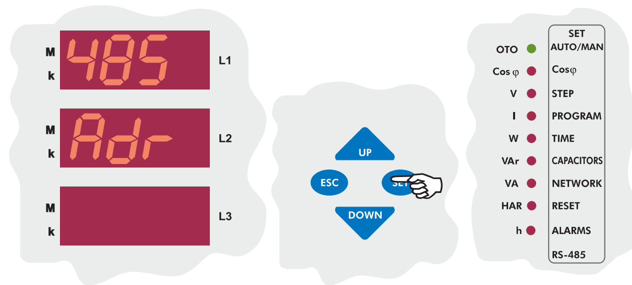
3 sec. Press **"SET"** button for 3 sec. in order to enter to the menu.



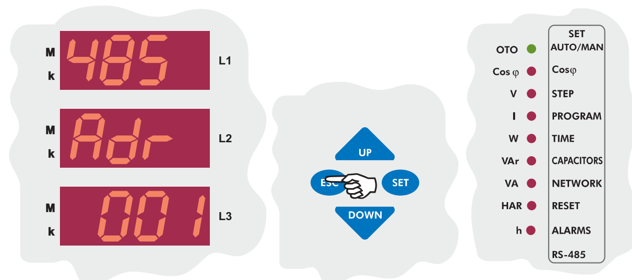
By **"UP/DOWN"** buttons, find computer communication **(RS-485)** menu.



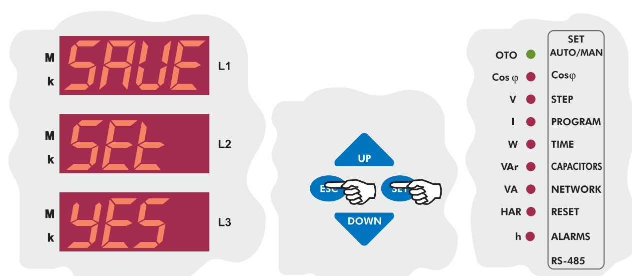
Press **"SET"** button for address setting.



Press **"SET"** button to set address value.



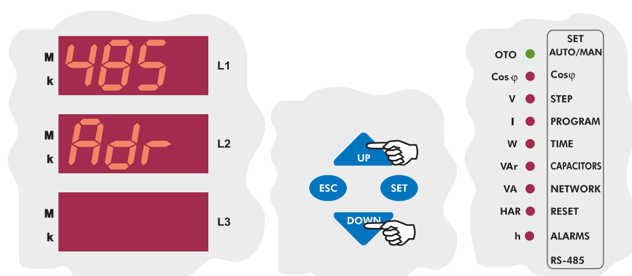
Enter the communication address between 1-247 and press **"SET"** button. If you do not set another parameter, press **"ESC"** button.



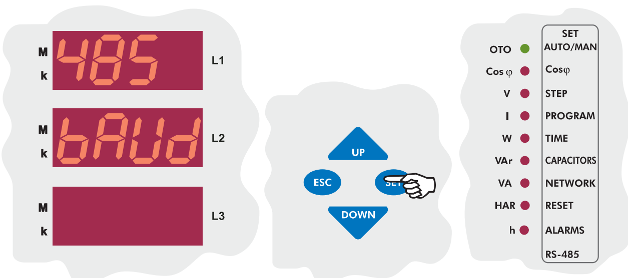
If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.11.b Baud Rate Setting

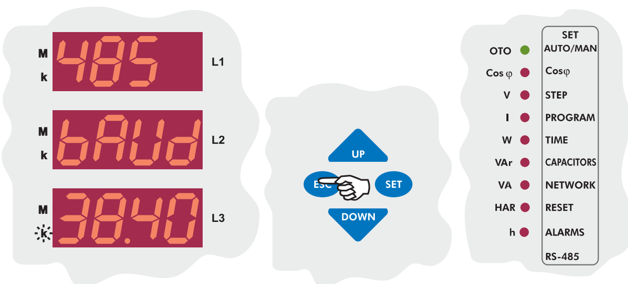
Baud rate value can be set as 1.200 Kbps, 2.400 Kbps, 4.800 Kbps, 9.600 Kbps, 19.20 Kbps, 38.40 Kbps in this menu.



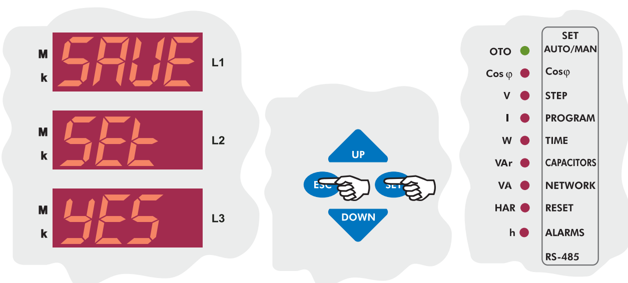
By **"UP/DOWN"** buttons, find baud rate **(bAUd)** menu.



Press **"SET"** button to set baud rate value.



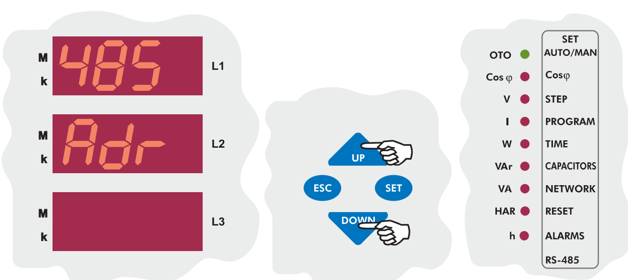
By **"UP/DOWN"** buttons, enter baud rate value (1.200 - 2.400 - 4.800 - 9.600 - 19.20 - 38.40) and press **"SET"** button. If you do not want to set another parameter, press **"ESC"** button.



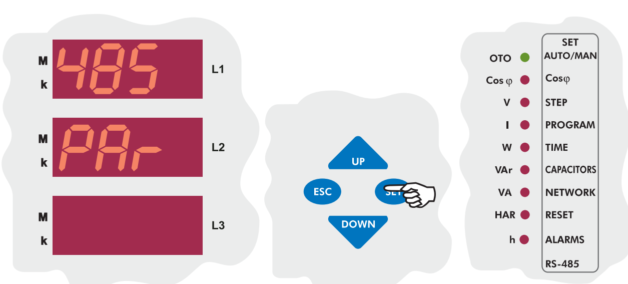
If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.11.c Parity Setting

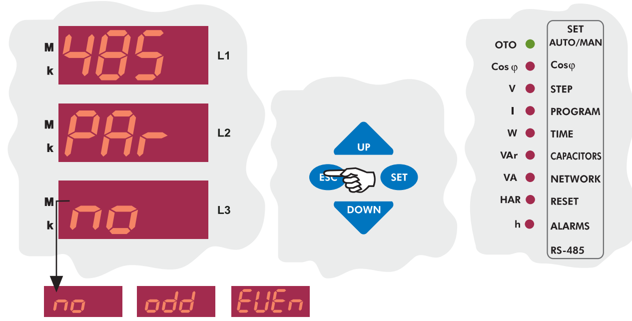
In this menu, Parity value can be set as **"no", "odd"** or **"EVEn"**.



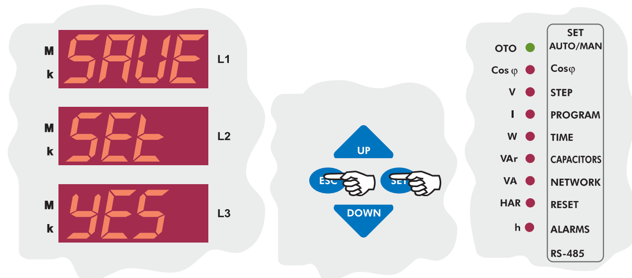
By **"UP/DOWN"** buttons, find baud rate(baud) menu.



Press **"SET"** button to set parity value.



By **"UP/DOWN"** buttons, select a parity option and press **"SET"** button. If you do not want to set another parameter, press **"ESC"** button.



If you do not want to set another parameter, in order to quit from the menu, press **"ESC"** button one by one until ***"SAVE SEt yES"*** is displayed. Press ***"SET"*** button to save your changes or press **"ESC"** button to quit without saving.

3.12 Password Activation and Change Settings

User password can be changed and activated in this menu. When the password is activated, a pin code is always required before entering to the menu.

Thus, user password prevents to change the settings of the device by unauthorized people. For this reason, a pin code with 4 digits must be set and then it must be activated.

Note : Factory set value for pin code is "1234" and also it is not activated.

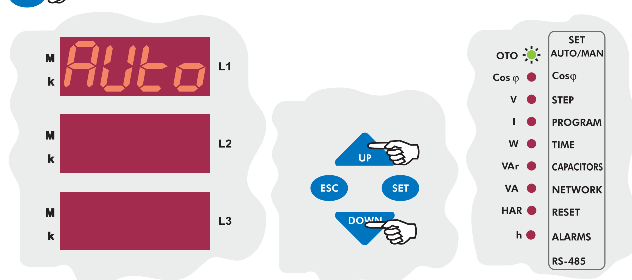
3.12.a Pin Activation

In this menu, user password is activated. When the password is activated, a pin code is always required before entering to the menu.

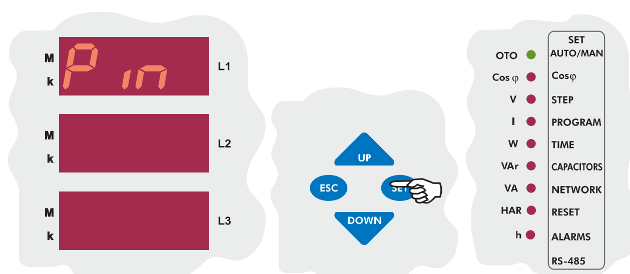
3 sec.



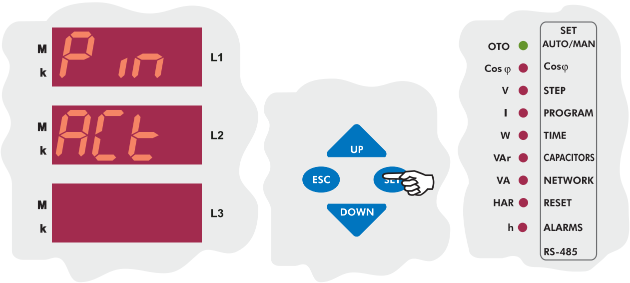
Press **"SET"** button for 3 sec. in order to enter to the menu.



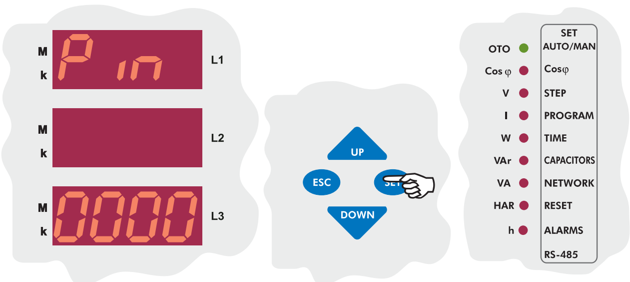
By **"UP/DOWN"** buttons, find **"Pin"** menu.



Press **"SET"** button to set password.

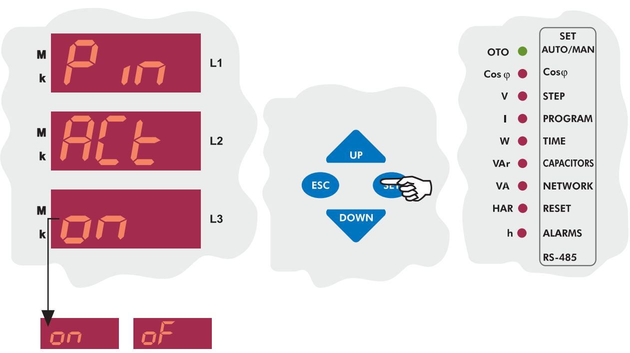


Press **“SET”** button to set **“Pin ACt”** parameter. Password can be set as “inactive” or “active”.

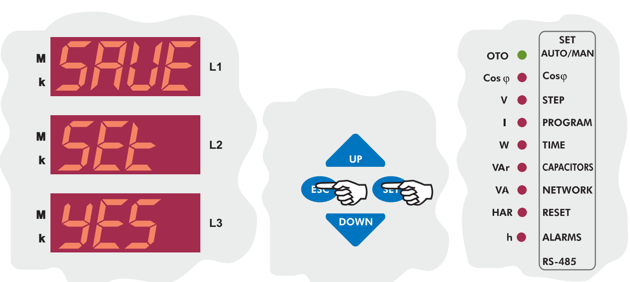


If you did not activate the password before, enter the pin code as **“1234”**. Press **“SET”** button to activate or inactivate the password.

Note: While entering the pin code, blinking digit represents that which digit will be set. By using “UP/DOWN” buttons, value of the related digit is increased or decreased. Press “SET” button to set next digit or press “ESC” button to set previous digit.



By **“UP/DOWN”** buttons, **“Pin ACt”** parameter is selected as “on” or “of” and then press **“SET”** button. If you do not want to set another parameter, press **“ESC”** button.



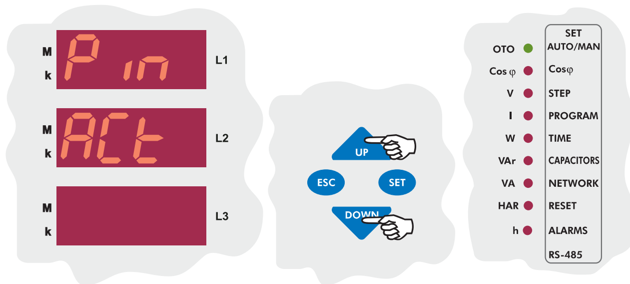
If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

Note : If you do not save your changes, they will not be valid.

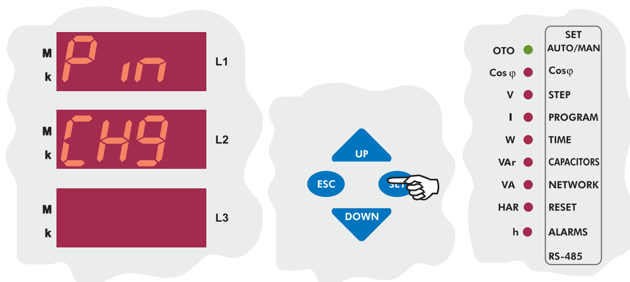
Note : If you do not want to set another parameter, in order to quit from the menu, press “ESC” button sequencelly until “SAVE SEt yES” is displayed. Press “SET” button to save your changes or press “ESC” button to quit without saving.

3.12.b Pin Change

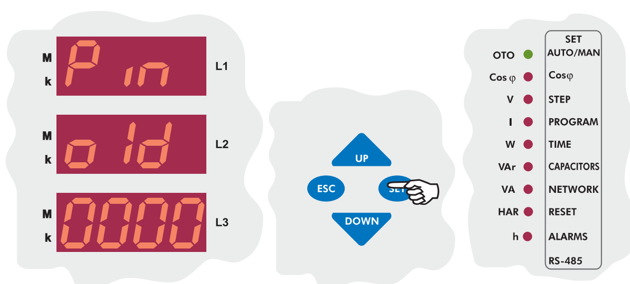
In this menu, user password is changed. In order to change the password, old password and new password (x2 times) must be entered.



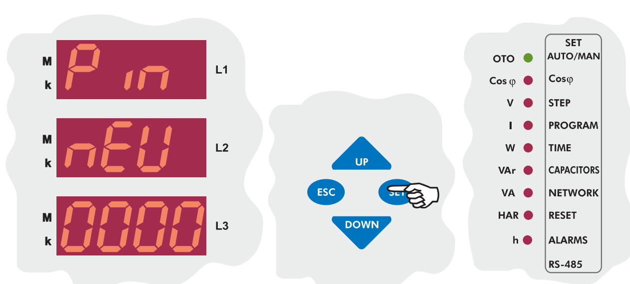
In **“Pin ACt”** menu, press **“DOWN”** button to find **“Pin CHg”** menu.



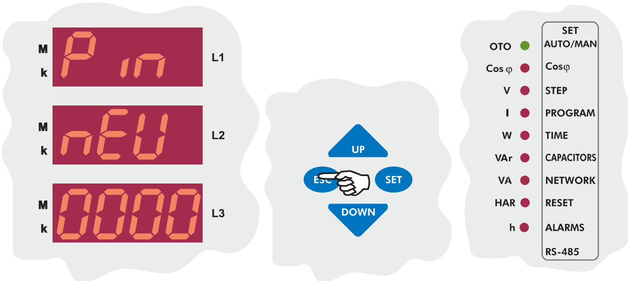
Press **“SET”** button to change the password.



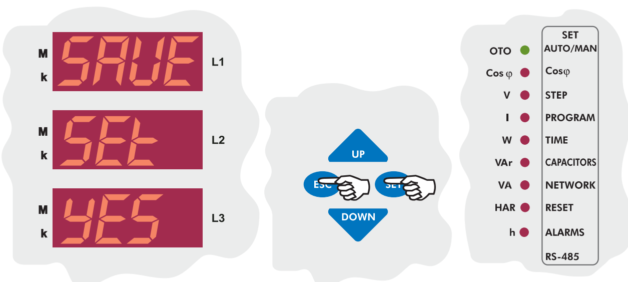
In order to define the new password, first of all, old password must be entered. After entering the old password, press **“SET”** button.



After entering new password, press **“SET”** button.



Enter the new password again and press **“SET”** button. If you do not want to set another parameter, press **“ESC”** button.



If you do not want to set another parameter, in order to quit from the menu, press **“ESC”** button one by one until ***“SAVE SEt yES”*** is displayed. Press ***“SET”*** button to save your changes or press **“ESC”** button to quit without saving.

4. DISPLAYING OF INSTANTANEOUS VALUES

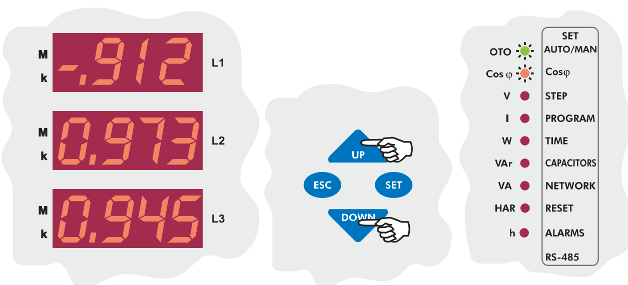
In the “Instantaneous Values” menu, below parameters can be observed by using **“UP”**, **“DOWN”** and **“SET”** buttons.

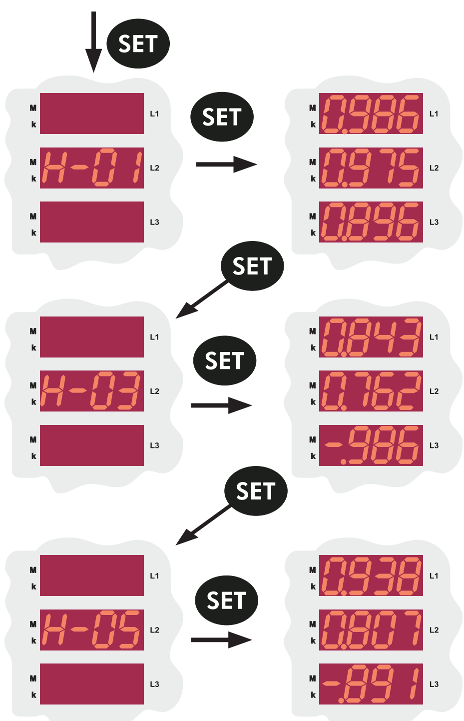
Voltage L-N	- Currents	- Cosφ	- ΣCosφ	- Active (W)	- Reactive (VAr)
Apparent (VA)	- ΣPowers	- Energys	- THD%V	- THD%I	- Temperature

By pressing **“ESC”** button in any menu, **“Instantaneous Values”** menu can be displayed.
This is the main menu of RM-12P. If you wait without pressing the buttons in any menu, “Instantaneous Values” menu ıs displayed automatically. When RM-12P is powered up at first time, “Instantaneous Values” menu is displayed.

Cosφ

When device starts to operate, cosφ values of the 3-phase are displayed. Negative (-) sign represents that phase is capacitive and positive (+) sign represents that phase is inductive. As you can see in below example, first phase is capacitive, second and third phases are inductive.
While observing cosφ values, if **“SET”** button is pressed (Har led lights), harmonic values can be observed up to 19th harmonic (including odd harmonics).

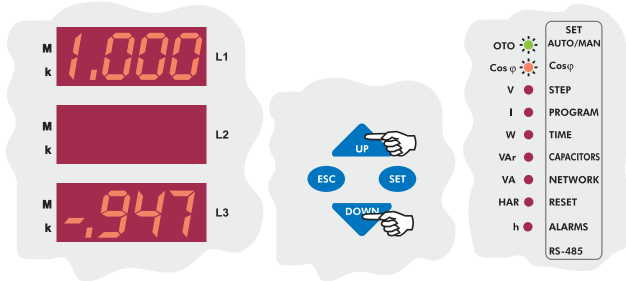




Cosφ and HAR leds on the display represent that displayed values are harmonic values of related cosφ. By pressing **“SET”** button one by one, all odd harmonic values can be observed up to 19th harmonic.

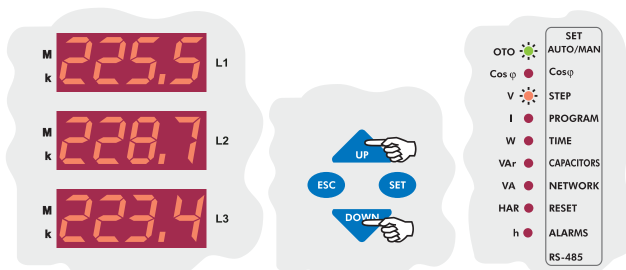
Total Cosφ

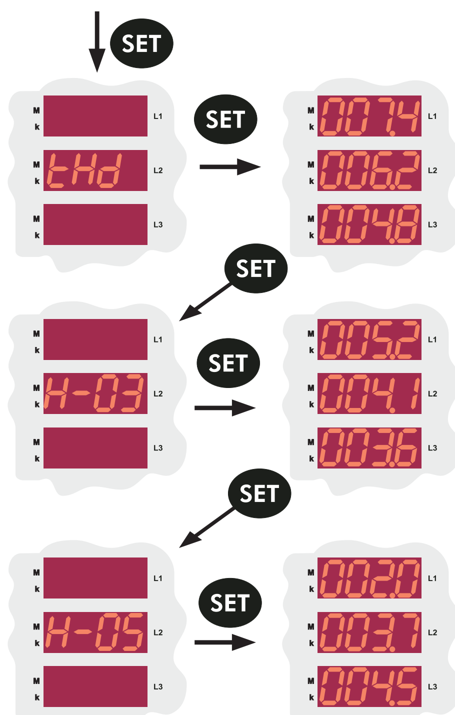
When cosφ menu is displayed, if **“DOWN”** button is pressed, total inductive cosφ and total capacitive cosφ values are observed. As you can see in below example, in first display, total inductive Cosφ value and in third display, total capacitive cosφ value is displayed.



Voltages

In the measurement mode, phase-neutral voltages can be displayed by using **“UP/DOWN”** buttons when V led lights. When phase voltages are displayed, if **“SET”** button is pressed (HAR led lights), odd harmonic values (up to 19th harmonic) can be observed.

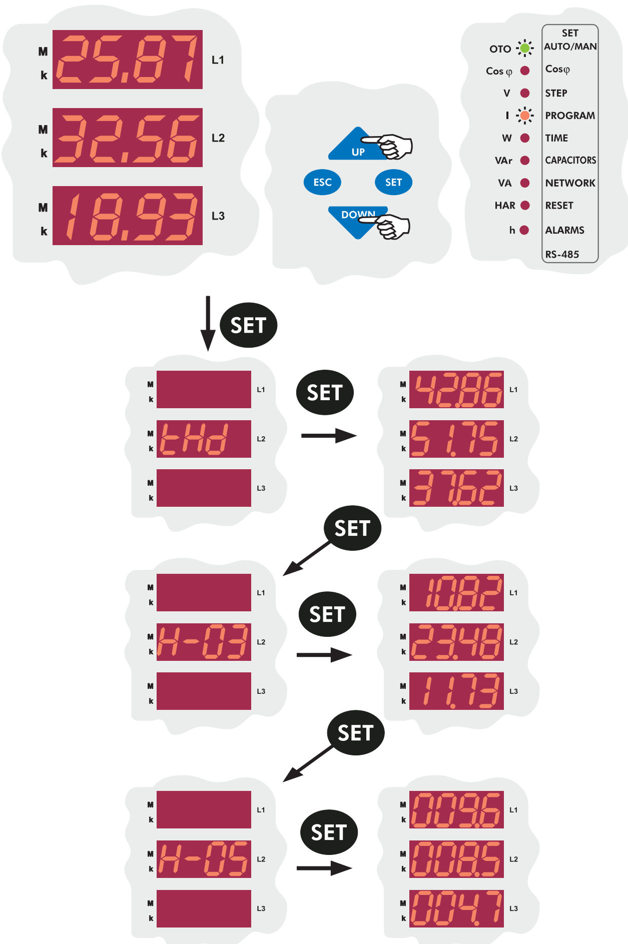




V and HAR leds on the display represent that displayed values are voltage harmonic values. By pressing **“SET”** button one by one, odd harmonic values (up to 19th harmonic) and THD values can be observed.

Currents

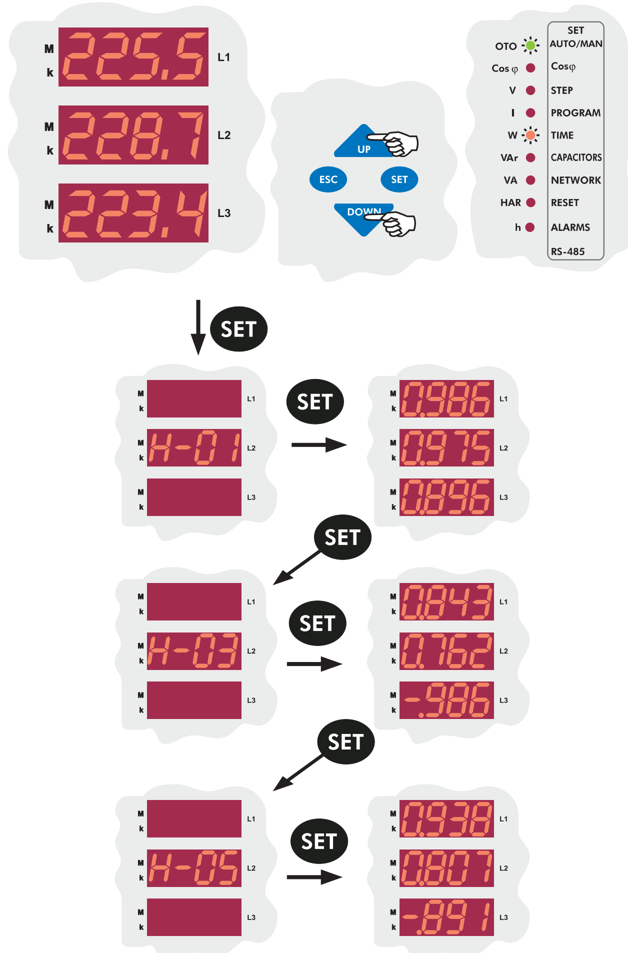
In the measurement mode, phase-phase current values can be displayed by using **"UP/DOWN"** buttons when I led lights.
When phase current values are displayed, if **"SET"** button is pressed (HAR led lights), odd harmonic values (up to 19th harmonic) can be observed.
If the point at the most right digit blinks, it represents that displayed active power value is export active power value.



I and HAR leds on the display represent that displayed values indicate current harmonic values. By pressing **"SET"** button one by one, odd harmonic values (up to 19th harmonic) and THD values can be observed.

Active Powers

In the measurement mode, active power values can be displayed by using **"UP/DOWN"** buttons when W led lights. When active power values are displayed, if **"SET"** button is pressed (HAR led lights), odd harmonic values (up to 19th harmonic) can be observed.

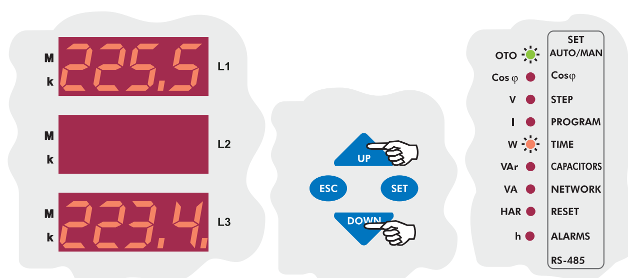


W and HAR leds on the display represent that displayed values indicate active power harmonic values. By pressing "SET" button one by one, odd harmonic values (up to 19th harmonic) can be observed.

Total Active Powers

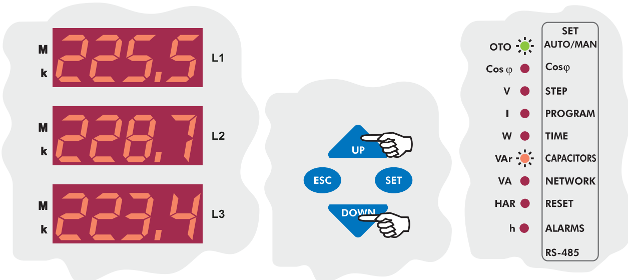
When active power values are displayed, if **"DOWN"** button is pressed, import active and export active power values are displayed. As seen in below , first example in, total active import power vales and in third display, total active export valves are displayed.

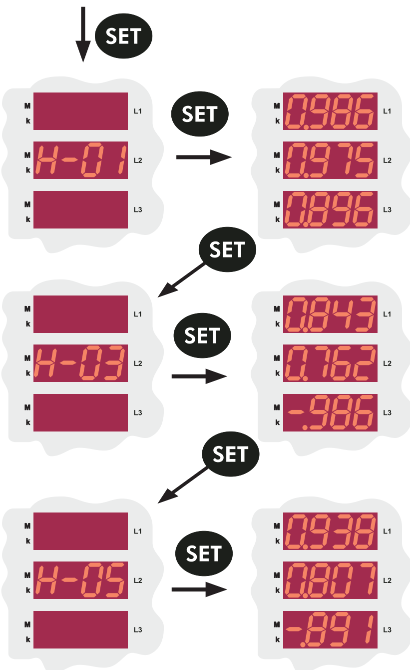
Note : The dot at the most right digit of the third display represents that displayed value is export active power value.



Reactive Powers

In the measurement mode, reactive power values are displayed by using **"UP/DOWN"** buttons when VAr led lights. When reactive power values are displayed, if **"SET"** button is pressed (HAR led lights), odd harmonic values (up to 19th harmonic) can be observed.



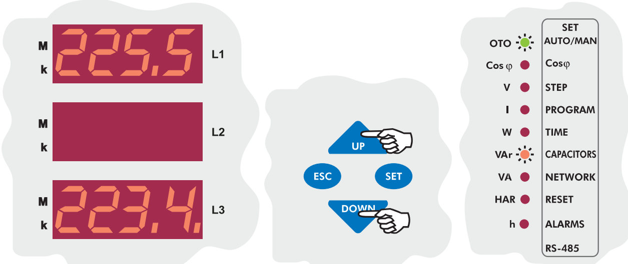


VAr and HAR leds on the display represent that displayed values indicate harmonic values of the reactive powers. By pressing **"SET"** button one by one, odd harmonic values (up to 19th harmonic) can be observed

Total Reactive Powers

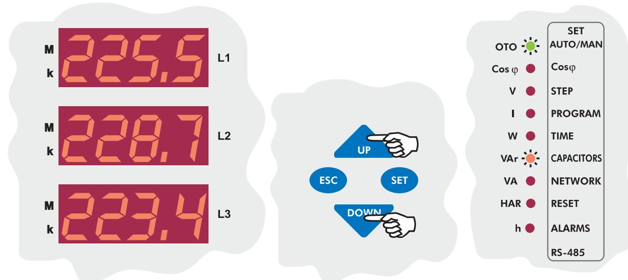
When active power values are displayed, if **"DOWN"** button is pressed, inductive reactive and capacitive reactive power values are observed. As seen in below example, in first display, total reactive inductive power value and in third display, total reactive capacitive power value is displayed.

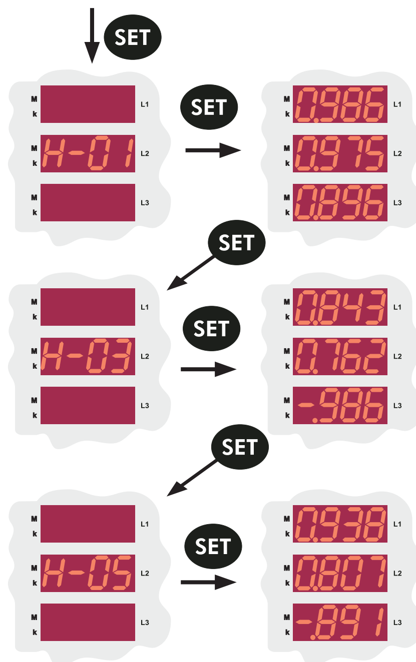
Note : The dot at the most right digit of the third display represents that displayed value is capacitive reactive power value.



Apparent Powers

In the measurement mode, aparent power values are displayed by using **"UP/DOWN"** buttons when VA led lights. When apparent power values are displayed, if **"SET"** button is pressed (HAR led lights), odd harmonic values (up to 19th harmonic) can be observed.

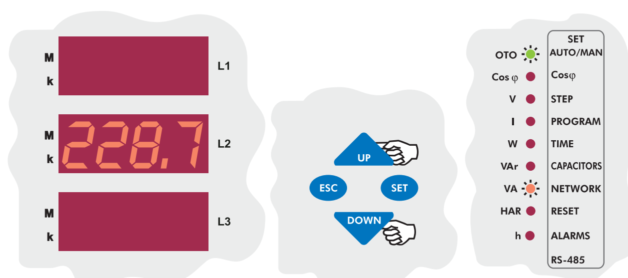




VA and HAR leds on the display represent that displayed values indicate harmonic values of the apparent powers. By pressing **"SET"** button one by one, odd harmonic values (up to 19th harmonic) can be observed.

Total Apparent Powers

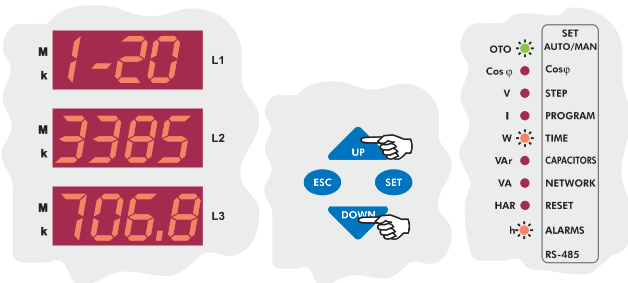
When apparent power values are displayed, if **"DOWN"** button is pressed, total apparent power is displayed in second display.



Active Import Energ

In the measurement mode, active import and active export energy values can be observed by using **"UP/DOWN"** buttons, when W and h leds light.

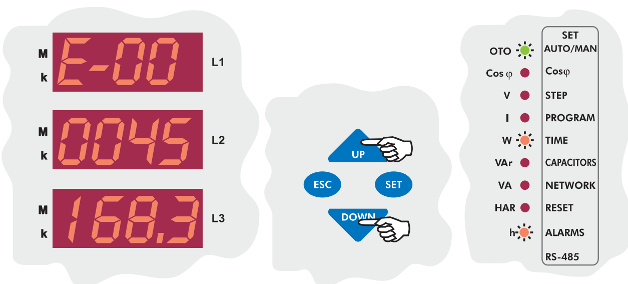
In below example, **"I"** represents that displayed parameter is import energy and the remaining numbers show the energy value.
(such as 203385706,8 kWh)



Active Export Energy

When active import energy is displayed, if **"DOWN"** button is pressed, active export energy is displayed.

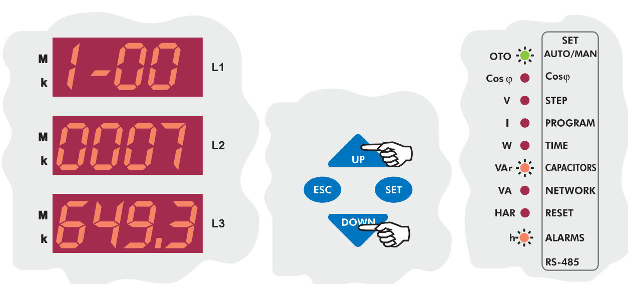
In below example, **"E"** represents that displayed parameter is export energy and the remaining numbers show the energy value. (such as 45168,3 kWh)

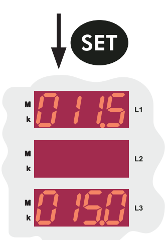


Note : When you reset energy values using energy counter reset menu, active and reactive energy values are both reset. (Refer to Page 14 - Reactive / Active ratio reset settings)

Inductive Reactive Energy

In the measurement mode, inductive reactive and ca pacitive reactive energy values can be observed by using **"UP/DOWN"** buttons when VAr and h leds light.
In below example, I represents that displayed parameter is import energy (inductive) and the remaining numbers show the energy value (such as 7649,3 kVarh).

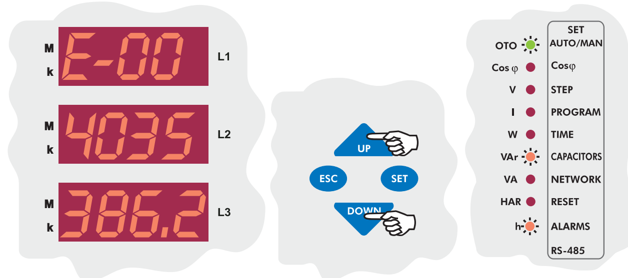


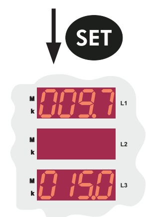


Inductive / Active ratio is displayed in first display and adjusted inductive/active ratio is displayed in third display.
(Refer to page 18 - Inductive ratio setting)

Capacitive Reactive Energy

In below example, **"E"** represents that displayed parameter is export (Capacitive) energy and the remaining numbers show the energy value (such as 4035386,2 kVArh)





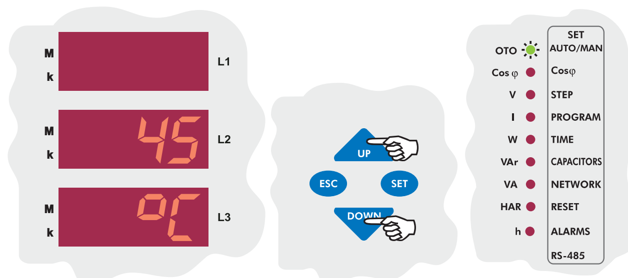
Capacitive / Active ratio is displayed in first display and adjusted capacitive / active ratio is displayed in third display.
(Refer to page 17 - Capacitive ratio setting).

Note: When you reset reactive / active ratio, the value in the first display is reset and the value is updated continiously. (Refer to page 14 - Reactive / Active ratio setting)

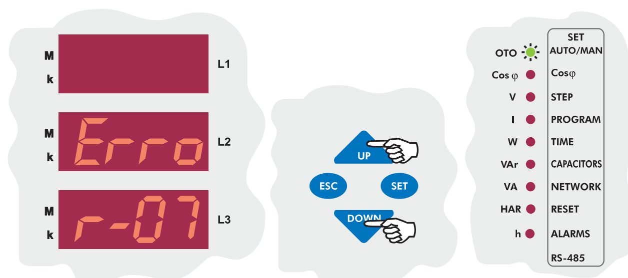
Temperature

temperature value which is measured via external connected thermocouple is displayed.
Below display represents that measured temperature is 45°C.

Note : This feature is optional.



Error Codes



Related Alarm LED is lighted if any failure is occured for any reason. When user request for monitoring the errors scrolling "UP/DOWN" buttons until displaying the Error-xx. This clause is not displayed if there is no error. All the error codes are displayed respectively by pressing the SET button. (such as Error - 07,12...)

Note : The descriptions and reasons for the error codes are mentioned in the alarm codes table. (Refer to Page 31 - Alarm Codes)

ALARM CODES

NO	DESCRIPTION	LED ☀	REASON
00	Angle degree between phase voltages doesn't equal to 120°	⅄	Neutral and Voltage terminal connections may be wrong
01	Reverse phase sequence	⅄	Voltage terminal connections may be in counter clockwise direction
02	One or more phase voltages don't exist	⅄	Voltage terminal connections may be wrong
03	Phase 1 Current	⅄	Current transformer connections for phase 1 may be wrong or fist capacitor step may be defected
04	Phase 2 Current	⅄	Current transformer connections for phase 2 may be wrong or first capacitor step my be defected
05	Phase 3 Current	⅄	Current transformer connections for phase 3 may be wrong or first capacitor step my be defected
06	THD for voltage exceeds the preset value	∿	Excessive harmonic may be exist in the system
07	Voltage value of any phases exceeds the preset value	V>	Voltage value of the system may be increased
08	Reactive capacitive ratio exceeds the preset value	%	Compensation Error
09	Reactive inductive ratio exceeds the preset value	%	Compensation Error
10	Temperature of the capacitors exceeds the preset value	* ✤	Over Temperature
11	Automatic connection could not be found	⅄	Defected capacitor step or variable loads
12	Over compensation	∦	Target Cosφ is capacitive even if all capacitor steps are switched off
13	Insufficient compensation	⫲	Capacitor powers are not sufficient for target Cosφ
14	Phase sequence is not correct	∦	3-phase capacitor powers were not selected properly
15	Capacitor power for phase 1 is not appropriate	∦	Capacitor powers for phase 1 were not selected properly
16	Capacitor power for phase 2 is not appropriate	∦	Capacitor powers for phase 2 were not selected properly
17	Capacitor power for phase 3 is not appropriate	∦	Capacitor powers for phase 3 were not selected properly
18	Capacitor step 1 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
19	Capacitor step 2 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
20	Capacitor step 3 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
21	Capacitor step 4 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
22	Capacitor step 5 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
23	Capacitor step 6 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
24	Capacitor step 7 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
25	Capacitor step 8 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
26	Capacitor step 9 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
27	Capacitor step 10 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
28	Capacitor step 11 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
29	Capacitor step 12 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
30	Capacitor step 13 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown
31	Capacitor step 14 is defected	⫲	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phases is blown

*Optional

REGISTER TABLE

NO	ADDRESS (HEX)	PARAMETER	FORMAT	MULTIPLIER	UNIT	FUNCTION
0 1	0000	PHASE 1 VOLTAGE	unsigned long int	0.1	VOLT	READ
2 3	0002	PHASE 2 VOLTAGE	unsigned long int	0.1	VOLT	READ
4 5	0004	PHASE 3 VOLTAGE	unsigned long int	0.1	VOLT	READ
6 7	0006	PHASE 1 CURRENT	unsigned long int	0.001	AMPER	READ
8 9	0008	PHASE 2 CURRENT	unsigned long int	0.001	AMPER	READ
10 11	000A	PHASE 3 CURRENT	unsigned long int	0.001	AMPER	READ
12 13	000C	PHASE 1 ACTIVE POWER	long int	0.1	WATT	READ
14 15	000E	PHASE 2 ACTIVE POWER	long int	0.1	WATT	READ
16 17	0010	PHASE 3 ACTIVE POWER	long int	0.1	WATT	READ
18 19	0012	PHASE 1 REACTIVE POWER	long int	0.1	VAR	READ
20 21	0014	PHASE 2 REACTIVE POWER	long int	0.1	VAR	READ
22 23	0016	PHASE 3 REACTIVE POWER	long int	0.1	VAR	READ
24 25	0018	PHASE 1 APPARENT POWER	unsigned long int	0.1	VA	READ
26 27	001A	PHASE 2 APPARENT POWER	unsigned long int	0.1	VA	READ
28 29	001C	PHASE 3 APPARENT POWER	unsigned long int	0.1	VA	READ
30 31	001E	PHASE 1 COSφ	long int	0.001	-	READ
32 33	0020	PHASE 2 COSφ	long int	0.001	-	READ
34 35	0022	PHASE 3 COSφ	long int	0.001	-	READ
36 37	0024	TOTAL ACTIVE POWER (IMPORT)	long int	0.1	WATT	READ
38 39	0026	TOTAL ACTIVE POWER (EXPORT)	long int	0.1	WATT	READ
40 41	0028	TOTAL REACTIVE POWER (IMPORT)	long int	0.1	VAR	READ
42 43	002A	TOTAL REACTIVE POWER (EXPORT)	long int	0.1	VAR	READ
44 45	002C	TOTAL APPARENT POWER	unsigned long int	0.1	VA	READ
46 47	002E	TOTAL IMPORT	long int	0.001	-	READ
48 49	0030	TOTAL EXPORT	long int	0.001	-	READ
50 51	0032	FREQUENCY	long int	0.01	HZ	READ
52 53	0034	PHASE 1 VOLTAGE VECTORIAL ANGLE	unsigned long int	1	ANGLE	READ
54 55	0036	PHASE 2 VOLTAGE VECTORIAL ANGLE	long int	1	ANGLE	READ

REGISTER TABLE

NO	ADDRESS (HEX)	PARAMETER	FORMAT	MULTIPLIER	UNIT	FUNCTION
56 57	0038	PHASE 3 VOLTAGE VECTORIAL ANGLE	long int	1	ANGLE	READ
58 59	003A	PHASE 1 CURRENT VECTORIAL ANGLE	long int	1	ANGLE	READ
60 61	003C	PHASE 2 CURRENT VECTORIAL ANGLE	long int	1	ANGLE	READ
62 63	003E	PHASE 3 CURRENT VECTORIAL ANGLE	long int	1	ANGLE	READ
64 65	0040	TEMPERATURE	long int	1	CELCIUS	READ
66 67	0042	CAPACITOR STEP STATUS	long int	-	-	READ
68 69	0044	ALARM STATUS	long int	-	-	READ/CLEAR
70 71	0046	INDUCTIVE REACTIVE ENERGY RATIO	long int	0.1	%	READ
72 73	0048	CAPACITIVE REACTIVE ENERGY RATIO	long int	0.1	%	READ
74 75 76 77	004A	IMPORT ACTIVE ENERGY COUNTER	64 BIT HEX	1	WH	READ/CLEAR
78 79 80 81	004E	IMPORT ACTIVE ENERGY COUNTER	64 BIT HEX	1	WH	READ/CLEAR
82 83 84 85	0052	IMPORT REACTIVE ENERGY COUNTER	64 BIT HEX	1	VARH	READ/CLEAR
86 87 88 89	0056	EXPORT REACTIVE ENERGY COUNTER	64 BIT HEX	1	VARH	READ/CLEAR
90 91 92 93	005A	IMPORT ACTIVE ENERGY COUNTER (RATIO)	64 BIT HEX	1	WH	READ/CLEAR
94 95 96 97	005E	EXPORT ACTIVE ENERGY COUNTER (RATIO)	64 BIT HEX	1	WH	READ/CLEAR
98 99 100 101	0062	IMPORT REACTIVE ENERGY COUNTER (RATIO)	64 BIT HEX	1	VARH	READ/CLEAR
102 103 104 105	0066	EXPORT REACTIVE ENERGY COUNTER (RATIO)	64 BIT HEX	1	VARH	READ/CLEAR
106	006A	PHASE 1 VOLTAGE THD	unsigned int	0.1	-	READ
107	006B	PHASE 1 VOLTAGE 3RD HARMONIC	unsigned int	0.1	%	READ
108	006C	PHASE 1 VOLTAGE 5TH HARMONIC	unsigned int	0.1	%	READ
109	006D	PHASE 1 VOLTAGE 7TH HARMONIC	unsigned int	0.1	%	READ
110	006E	PHASE 1 VOLTAGE 9TH HARMONIC	unsigned int	0.1	%	READ
111	006F	PHASE 1 VOLTAGE 11TH HARMONIC	unsigned int	0.1	%	READ

REGISTER TABLE						
NO	ADDRESS (HEX)	PARAMETER	FORMAT	MULTIPLIER	UNIT	FUNCTION
112	0070	PHASE 1 VOLTAGE 13TH HARMONIC	unsigned int	0.1	%	READ
113	0071	PHASE 1 VOLTAGE 15TH HARMONIC	unsigned int	0.1	%	READ
114	0072	PHASE 1 VOLTAGE 17TH HARMONIC	unsigned int	0.1	%	READ
115	0073	PHASE 1 VOLTAGE 19TH HARMONIC	unsigned int	0.1	%	READ
116	0074	PHASE 1 CURRENT THD	unsigned int	0.1	-	READ
117	0075	PHASE 1 CURRENT 3RD HARMONIC	unsigned int	0.1	%	READ
118	0076	PHASE 1 CURRENT 5TH HARMONIC	unsigned int	0.1	%	READ
119	0077	PHASE 1 CURRENT 7TH HARMONIC	unsigned int	0.1	%	READ
120	0078	PHASE 1 CURRENT 9TH HARMONIC	unsigned int	0.1	%	READ
121	0079	PHASE 1 CURRENT 11TH HARMONIC	unsigned int	0.1	%	READ
122	007A	PHASE 1 CURRENT 13TH HARMONIC	unsigned int	0.1	%	READ
123	007B	PHASE 1 CURRENT 15TH HARMONIC	unsigned int	0.1	%	READ
124	007C	PHASE 1 CURRENT 17TH HARMONIC	unsigned int	0.1	%	READ
125	007D	PHASE 1 CURRENT 19TH HARMONIC	unsigned int	0.1	%	READ
126	007E	PHASE 2 VOLTAGE THD	unsigned int	0.1	-	READ
127	007F	PHASE 2 VOLTAGE 3RD HARMONIC	unsigned int	0.1	%	READ
128	0080	PHASE 2 VOLTAGE 5TH HARMONIC	unsigned int	0.1	%	READ
129	0081	PHASE 2 VOLTAGE 7TH HARMONIC	unsigned int	0.1	%	READ
130	0082	PHASE 2 VOLTAGE 9TH HARMONIC	unsigned int	0.1	%	READ
131	0083	PHASE 2 VOLTAGE 11TH HARMONIC	unsigned int	0.1	%	READ
132	0084	PHASE 2 VOLTAGE 13TH HARMONIC	unsigned int	0.1	%	READ
133	0085	PHASE 2 VOLTAGE 15TH HARMONIC	unsigned int	0.1	%	READ
134	0086	PHASE 2 VOLTAGE 17TH HARMONIC	unsigned int	0.1	%	READ
135	0087	PHASE 2 VOLTAGE 19TH HARMONIC	unsigned int	0.1	%	READ
136	0088	PHASE 2 CURRENT THD	unsigned int	0.1	-	READ
137	0089	PHASE 2 CURRENT 3RD HARMONIC	unsigned int	0.1	%	READ
138	008A	PHASE 2 CURRENT 5TH HARMONIC	unsigned int	0.1	%	READ
139	008B	PHASE 2 CURRENT 7TH HARMONIC	unsigned int	0.1	%	READ
140	008C	PHASE 2 CURRENT 9TH HARMONIC	unsigned int	0.1	%	READ
141	008D	PHASE 2 CURRENT 11TH HARMONIC	unsigned int	0.1	%	READ
142	008E	PHASE 2 CURRENT 13TH HARMONIC	unsigned int	0.1	%	READ
143	008F	PHASE 2 CURRENT 15TH HARMONIC	unsigned int	0.1	%	READ
144	0090	PHASE 2 CURRENT 17TH HARMONIC	unsigned int	0.1	%	READ
145	0091	PHASE 2 CURRENT 19TH HARMONIC	unsigned int	0.1	%	READ
146	0092	PHASE 3 VOLTAGE THD	unsigned int	0.1	-	READ
147	0093	PHASE 3 VOLTAGE 3RD HARMONIC	unsigned int	0.1	%	READ
148	0094	PHASE 3 VOLTAGE 5TH HARMONIC	unsigned int	0.1	%	READ
149	0095	PHASE 3 VOLTAGE 7TH HARMONIC	unsigned int	0.1	%	READ
150	0096	PHASE 3 VOLTAGE 9TH HARMONIC	unsigned int	0.1	%	READ
151	0097	PHASE 3 VOLTAGE 11TH HARMONIC	unsigned int	0.1	%	READ
152	0098	PHASE 3 VOLTAGE 13TH HARMONIC	unsigned int	0.1	%	READ
153	0099	PHASE 3 VOLTAGE 15TH HARMONIC	unsigned int	0.1	%	READ
154	009A	PHASE 3 VOLTAGE 17TH HARMONIC	unsigned int	0.1	%	READ
155	009B	PHASE 3 VOLTAGE 19TH HARMONIC	unsigned int	0.1	%	READ
156	009C	PHASE 3 CURRENT THD	unsigned int	0.1	-	READ
157	009D	PHASE 3 CURRENT 3RD THD	unsigned int	0.1	%	READ
158	009E	PHASE 3 CURRENT 5TH THD	unsigned int	0.1	%	READ
159	009F	PHASE 3 CURRENT 7TH THD	unsigned int	0.1	%	READ
160	00A0	PHASE 3 CURRENT 9TH THD	unsigned int	0.1	%	READ
161	00A1	PHASE 3 CURRENT 11TH THD	unsigned int	0.1	%	READ
162	00A2	PHASE 3 CURRENT 13TH THD	unsigned int	0.1	%	READ
163	00A3	PHASE 3 CURRENT 15TH THD	unsigned int	0.1	%	READ
164	00A4	PHASE 3 CURRENT 17TH THD	unsigned int	0.1	%	READ
165	00A5	PHASE 3 CURRENT 19TH THD	unsigned int	0.1	%	READ
166	8000	VOLTAGE TRANSFORMER RATIO	unsigned int	1	-	READ/WRITE
167	8001	CURRENT TRANSFORMER RATIO	unsigned int	1	-	READ/WRITE

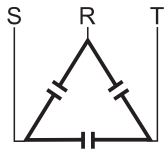
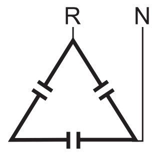
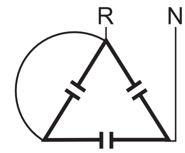
REGISTER TABLE

NO	ADDRESS (HEX)	PARAMETER	FORMAT	MULTIPLIER	UNIT	FUNCTION
168	8002	REACTIVE POWER CALCULATION METHOD	unsigned int	-	-	READ/WRITE
169	8003	TARGET COSφ	int	0.001	-	READ/WRITE
170	8004	TARGET COSφ 2	int	0.001	-	READ/WRITE
171	8005	CAPACITOR STEP NUMBER	unsigned int	-	-	READ/WRITE
172	8006	PROGRAM	unsigned int	-	-	READ/WRITE
173	8007	SWITCH ON TIME	unsigned int	0.1	SECOND	READ/WRITE
174	8008	SWITCH OFF TIME	unsigned int	0.1	SECOND	READ/WRITE
175	8009	CAPACITOR STEP DISCHARGE TIME	unsigned int	0.1	SECOND	READ/WRITE
176	800A	OVER VOLTAGE SET VALUE	unsigned int	0.1	VOLT	READ/WRITE
177	800B	OVER VOLTAGE DELAY	unsigned int	0.1	SECOND	READ/WRITE
178	800C	OVER VOLTAGE CAPACITOR STEP	unsigned int	-	-	READ/WRITE
179	800D	CAPACITIVE RATIO SET VALUE	unsigned int	0.1	%	READ/WRITE
180	800E	CAPACITIVE RATIO SET VALUE	unsigned int	0.1	%	READ/WRITE
181	800F	TEMPERATURE ALARM SET VALUE	unsigned int	0.1	CELCIUS	READ/WRITE
182	8010	TEMPERATURE ALARM END VALUE	unsigned int	0.1	CELCIUS	READ/WRITE
183	8011	TEMPERATURE ALARM STEP SITUATION	unsigned int	-	-	READ/WRITE
184	8012	OVER THDV SET VALUE	unsigned int	0.1	-	READ/WRITE
185	8013	OVER THDV DELAY	unsigned int	0.1	SECOND	READ/WRITE
186	8014	OVER THDV CAPACITOR STEP SITUATION	unsigned int	-	-	READ/WRITE
187	8015	MODBUS ADDRESS	unsigned int	-	-	READ/WRITE
188	8016	RS-485 BAUD RATE	unsigned int	-	-	READ/WRITE
189	8017	RS-485 PARITY	unsigned int	-	-	READ/WRITE
190	8018	PASSWORD ACTIVATION	unsigned int	-	-	READ/WRITE
191	8019	PASSWORD	decimal	-	-	READ/WRITE
192	801A	-	unsigned int	-	-	READ/WRITE
193	801B	-	unsigned int	-	-	READ/WRITE
194	801C	FAN OPERATING TEMPERATURE VALUE	unsigned int	0.1	CELCIUS	READ/WRITE
195	801D	FAN STOPPAGE TEMPERATURE VALUE	unsigned int	0.1	CELCIUS	READ/WRITE
196	8080	1ST CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
197	8081	2ND CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
198	8082	3RD CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
199	8083	4TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
200	8084	5TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
201	8085	6TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
202	8086	7TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
203	8087	8TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
204	8088	9TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
205	8089	10TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
206	808A	11TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
207	808B	12TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
208	808C	13TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
209	808D	14TH CAPACITOR STEP POWER	unsigned int	0.1	VAR	READ/WRITE
210	808E	1ST CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
211	808F	2ND CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
212	8090	3RD CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
213	8091	4TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
214	8092	5TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
215	8093	6TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
216	8094	7TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
217	8095	8TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
218	8096	9TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
219	8097	10TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
220	8098	11TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
221	8099	12TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
222	809A	13TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE
223	810A	14TH CAPACITOR STEP CONNECTION	unsigned int	-	-	READ/WRITE

REGISTER TABLE

NO	ADDRESS (HEX)	PARAMETER	FORMAT	MULTIPLIER	UNIT	FUNCTION
224	9000	5TH CAPACITOR STEP SWITCH ON&OFF	-	-	-	WRITE
225	9001	6TH CAPACITOR STEP SWITCH ON&OFF	-	-	-	WRITE
226	9002	7TH CAPACITOR STEP SWITCH ON&OFF	-	-	-	WRITE
227	9003	8TH CAPACITOR STEP SWITCH ON&OFF	-	-	-	WRITE
228	9004	9TH CAPACITOR STEP SWITCH ON&OFF	-	-	-	WRITE
229	9005	10TH CAPACITOR STEP SWITCH ON&OFF	-	-	-	WRITE
230	9006	11TH CAPACITOR STEP SWITCH ON&OFF	-	-	-	WRITE
231	9007	12TH CAPACITOR STEP SWITCH ON&OFF	-	-	-	WRITE
232	9008	13TH CAPACITOR STEP SWITCH ON&OFF	-	-	-	WRITE
233	9009	14TH CAPACITOR STEP SWITCH ON&OFF	-	-	-	WRITE
234	900A	AUTOMATIC / MANUAL MODE SELECTION	-	-	-	WRITE
235	900B	AUTOMATIC SETUP	-	-	-	WRITE
236	900C	ALARM DELETE	-	-	-	WRITE
237	900D	ENERGY DELETE	-	-	-	WRITE
238	900E	RATIO DELETE	-	-	-	WRITE
239	900F		-	-	-	WRITE
240	9010		-	-	-	WRITE
241	9011		-	-	-	WRITE
242	9012		-	-	-	WRITE

CAPACITOR CALCULATION TABLE

			
CAPACITOR POWERS	**3-PHASE CONNECTION (Q/3)**	**PHASE-NEUTRAL CONNECTION (Q/6)**	**PHASE-NEUTRAL BRIDGE CONNECTION (2xQ/9)**
0,5 KVAR	0,16 KVAR	0,08 KVAR	0,11 KVAR
1 KVAR	0,33 KVAR	0,16 KVAR	0,22 KVAR
1,5 KVAR	0,5 KVAR	0,25 KVAR	0,33 KVAR
2,5 KVAR	0,83 KVAR	0,41 KVAR	0,55 KVAR
5 KVAR	1,66 KVAR	0,83 KVAR	1,11 KVAR
7,5 KVAR	2,5 KVAR	1,25 KVAR	1,66 KVAR
10 KVAR	3,33 KVAR	1,66 KVAR	2,22 KVAR
15 KVAR	5 KVAR	2,5 KVAR	3,33 KVAR
20 KVAR	6,66 KVAR	3,33 KVAR	4,44 KVAR
25 KVAR	8,3 KVAR	4,1 KVAR	5,5 KVAR
30 KVAR	10 KVAR	5 KVAR	6,66 KVAR

In first column, total reactive power values of 3-phase capacitors and in second & third columns, reactive power values of the capacitors in single phase system are mentioned.

Technical Features

Operating Voltage (Un)	: 3x220 V AC, 3x230 V AC, 3x240 V AC (Phase-Neutral Connection)
Operating Voltage Range ΔU	: (0.9-1.1) x Un
Operating Current Range ΔI	: 50 mA-5.5 A
Frequency	: 50 Hz / 60 Hz
Measurement Class	: 1% ±1 digit (V, I, Cosφ), 2% ±1 digit (W, VAr, VA, Wh) (100mA-5.5A) 3 A, 250 V AC, 750 VA
Power Consumption	: <2 VA (Current) 3 VA - 10 VA (Voltage)
Output Contact	: 3 A, 750 VA
No-Volt Feature	: In case of power failure (for phase 1) longer than 20 msec. , all capacitor steps are disconnected automatically
Setting Range	
Cosφ Setting	: Ind. 0,800 - Cap. 0,800
Cosφ2 Setting	: Ind. 0,800 - Cap. 0,800
CT Ratio	: 1 - 2000
VT Ratio	: 1 - 2000
Switching on&off and Discharge Time Setting	: Switching on & off and discharge times can be set between 1 - 1800 sec.
Step Number	: 12
Over Voltage Setting	: Selectable
Ambient Temperature Range	: -5° C - 55° C
Measurement Temp. Range*	: 00.0 - 100 °C
Display	: Red Led Display with 4 digits
Equipment Protection Class	: Double Insulation (⧈)
Wire Thickness (for terminals)	: 2.5 mm^2
Box Protection Class	: IP 00 (Terminal)
	: IP 40 (Front panel)
Installation	: Flush mounting with rear terminals
Dimension	: Type PR16
Panel Cut-out	: 139 x 139 mm
Weight	: 0.8 kg.
RS-485 Communication	
Address	: 1 - 247
Baud Rate	: 1.200 Kbps, 2.400 Kbps, 4.800 Kbps, 9.600 Kbps, 19.20 Kbps, 38.40 Kbps
Parity	: no, odd, even
Factory Set Values	
Target Cosφ	: 1,000 (inductive)
Target Cosφ2	: 0,900 (inductive)
Program	: PS10
t-on (swirtd-on delay)	: 10 sec.
t-off (swirtd-off delay)	: 10 sec.
Discharge time	: 14 sec.
Over Voltage	: 260.0 V AC
Delay	: 3.0 sec.
Step protection	: Off
Over Harmonic	: 7.0%
Delay	: 1.0 sec.
Step protection	: Off
Inductive Ratio Range	: 25
Capacitive Ratio Range	: 15
Temperature Protection *	
Alarm Value	: 55 °C
Step Protection	: oFF
Lower Alarm	: 53 °C
Fan Setting *	
Operation Temperature	: 45 °C
Lower Temp. Value	: 40 °C
CT Ratio	: 1
VT Ratio	: 1
RS-485 Communication	
Address	: 1
Baud Rate	: 9.600 Kbps
Parity	: no

*** Optional**